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THE PLAGUE IN SAN FRANCISCO.

IN the spring of 1900 the city bacteriologist of San Francisco and the quarantine surgeon of the Marine Hospital Service, stationed at Angel Island, San Francisco Bay, made the discovery that the death of a Chinaman had been caused by plague. In accordance with the provisions of the laws governing these two officers in their respective functions, the case was officially reported. Other cases soon developed, and the occurrence of these cases was likewise officially reported. The reports of the quarantine surgeon were published in the Public Heath Reports of the Marine Hospital Service in accordance with law and with international agreements. The truth of the reports was at once questioned by the larger portion of the local public press, the objections being partly of a political and partly of a commercial character. A certain portion of the medical profession also opposed the recognition of the diagnosis, and the opinions of these physicians constituted the basis of the denial by the press of the truth of the existence of plague. The diagnosis had been established in accordance with the conceptions of plague as determined by the scientific study of the

disease in the Orient by Yersin and Haffkine, and by the various plague commissions which were sent to the Orient by various European governments for the study of plague; in short, the diagnosis was established precisely as it was in India, China, Japan, Portugal, Alexandria, Sydney and Cape Town; and the fact that the scientific methods, which in the countries quoted are unreservedly accepted as trustworthy and reliable, were in San Francisco disregarded and ridiculed is a sad commentary upon that portion of the medical profession which maintained the negative attitude.

Fearing that the State Board of Health might quarantine the city and that other States might quarantine the city, or even the State, to the vast injury of public and commercial interests, the commercial interests of the city solicited the establishment by the City Board of Health of a quarantine of 'Chinatown,' the portion of the city occupied by the Chinese in which all the reported cases had occurred. This request was acceded to, and the quarantine was established. At the solicitation of the railway companies, the Marine Hospital Service, through its surgeon-general in Washington, though against the protest of the surgeon stationed at Angel Island, laid a similar quarantine against 'Chinatown.' The public was given to understand that plague was a disease of frightful contagiousness and rapid spread, and that this quarantine was necessary to prevent the spread of the disease through the entire city. The quarantine, though inadequately enforced and obviously ineffective, was quite naturally obnoxious to the Chinese residents of the quarantined area, and they sought relief in the courts.

In the opinion rendered upon the case, Judge Morrow decided the establishment and maintenance of the quarantine illegal, but marred what was, under the laws, a correct decision by the prejudicial and unwarranted statement that no cases of plague had existed in San Francisco. That the quarantine was, in the light of our knowledge of plague and in the light of the Oriental experiences with the disease, an unwarranted and mistaken procedure is obvious. As a rule plague is not a personal infection, it is a house infection; the best evidence of this fact is the statement of one of the European commissions that about the safest place in Bombay is the plague hospital. As a general rule plague may be said to become a personal infection only when the pneumonic form is prevalent, and even under such circumstances the sensitiveness of the *Bacillus pestis* to sunlight and desiccation renders the infectiousness of the disease much less than is observed with other infections. As stated, the public in San Francisco had been led to believe that plague was a disease of frightful contagiousness; when then the quarantine was raised, and the Chinese population was allowed to go where it chose in the light of the aforestated information, the disease was expected to spread at once through the city. It did, of course, nothing of the sort. And naturally the general public at once lost confidence in the local board of health and in the correctness of the diagnosis.

Following this date fresh cases occurred from time to time, and the occurrence of these cases was officially reported by the city bacteriologist and by the surgeon of the Quarantine Station of the Marine Hospital Service. The public press then began a campaign of personal abuse of Surgeon Kinyoun, the quarantine surgeon of the Marine Hospital Service, though this officer had done nothing but follow his orders and obey the law. Matters dragged on until the opening of the State Legislature. In his message, his Excellency Governor Gage denied the existence of plague in the State and passed severe strictures upon the surgeon of the Marine Hospital Service. A motion was then introduced into the Legislature requesting the National Government to recall surgeon Kinyoun, the implication again being that Dr. Kinyoun had exceeded his authority, a charge which was entirely unfounded, as every other surgeon in the service would of necessity have done exactly as did Dr. Kinyoun. Dr. Kinyoun thereupon demanded an investigation of the hygienic state of affairs in San Francisco. The Treasury Department thereupon sent to San Francisco a special committee composed of men of international reputation as experts in matters of the kind, men entirely without connection with the Marine Hospital Service, and in fact connected with large institutions of public learning. The committee consisted of Professor Flexner, of the University of Pennsylvania, Professor Novy, of the University of Michigan, and Professor Barker, of the University of Chicago.

Upon the advent in San Francisco of these gentlemen, bills were introduced into the State Legislature making it a criminal offense for any one to report the existence of plague without the confirmation of the State Board of Health, and prohibiting the handling of cultures of the *Bacillus pestis* as prejudicial to the public health; these bills were not pushed, and did not pass; they are mentioned simply to illustrate the mental attitude from which they sprang. It had been previously charged that the bacteriologists reporting the cases of plague had intentionally infected with the *Bacillus pestis* the bodies of Chinamen dead of other causes, in order to bolster up their diagnoses; this absurdly vindictive charge is repeated simply to illustrate to what an appalling extent of mental and moral error prejudice will carry men. The special commission spent several weeks in San Francisco, saw and studied six cases of plague, and presented a report confirming the existence of the disease in the city. On the receipt of the information of the contents of this report, a committee of citizens went to Washington, and an agreement was entered into with the national authorities, that the city of San Francisco and the State of California were to furnish the funds wherewith the section of the city known as Chinatown was to be cleaned and disinfected under the supervision of an officer of the Marine Hospital Service, and this disinfection is now in progress.

That the existence of plague in San Francisco has been of considerable commercial loss to the State is without question. That the misfortune of the occurrence of plague in San Francisco must, in the

nature of things, have been attended with some commercial loss is obvious. The men who have maintained the existence of the disease have the interests of the State as closely at heart as have those who have opposed the diagnosis; they differ in their convictions as to the best and least injurious method of procedure. The men who have maintained the existence of plague reason thus: Plague is here; clinically, pathologically and bacteriologically it has been proved to be here. Under the circumstances the best method of procedure, the one affording the best protection to the public health and the least injury to the business interests of the State, is to acknowledge the truth, undertake energetic measures, and clean and disinfect 'Chinatown' in such a manner as to stamp out the disease at once. The opposition comprises two sets of men. One set does not believe that plague is here, and for them there can be no necessity for hygienic action. Though honest in their convictions, it must be insisted on that the existence of plague is a matter for scientific consideration, and is not within the scope of the judgment of business men. The second class realizes that the disease is present, but reasons that, as there are so few cases and as these are largely confined to Chinese, the situation is not serious and should be concealed in the hope that the disease will die out, and that public recognition and active hygienic measures should be deferred until the conditions become so serious that the public health is gravely jeopardized. The scientists know that there are but few cases, that the general health is not in serious danger, but believe it better to stamp out the infection while in its infancy, with the attendant small commercial loss, than to wait, in the hope that the disease will die out of its own accord, until the situation shall have become very serious, with the risk of overwhelming commercial losses in the event of a generalization of the infection.

There can be no question that the first course was the correct one. That now, one year after the trouble began, the State is compelled to do what it all along refused to do, undertake the hygienic renovation of 'Chinatown,' is an obvious proof of the correctness of the frank and open course. Had the Chinese section been promptly and effectively cleaned one year ago, the disease would have been stamped out at little cost, and the episode would have been ere this forgotten. At present the pall still hangs over California, and there is a general distrust of her on the part of the other States. We trust that the present measures will prove effective, and that the State has escaped the occurrence of a serious epidemic; but this escape will have been purely accidental, and in matters like these a community has not the right to trust to the fortune of chance.

Conditions have apparently not been favorable to the immediate spread of the disease. This is, however, an old experience; in many places and at many times the plague has dragged along for a long while, only to suddenly flare up into an active epidemic. The recent experience in Cape Town is a fresh illustration. The plague has been present and dragging along in

Cape Town for eighteen months; on account of the military situation, its effective eradication was neglected, and now the disease has roused into active form. It is this risk which San Francisco has been running, and this risk no community has the right to assume.

THE DESTRUCTION OF SEA LIONS IN CALIFORNIA.

PROFESSOR WOODWARD'S wholesome address on the necessity of verifying theories by the observation of facts finds an excellent illustration in the sea lion question in California. These animals, which have long been prized by lovers of nature as one of the great attractions of the coast, have fallen into disrepute among the fishermen because their presence was supposed to account for the deterioration of certain fishing grounds. So confident was the belief in their fish-devouring habits that their destruction—or at least a great reduction of their numbers—was advocated and in part accomplished by the State Commission of Fisheries. But it now appears that this belief was without substantial foundation. The appeal to fact has been made by the critical examination of the stomachs of slaughtered sea lions, and it has been found by Professor Dyche that the twenty-five animals examined had eaten only squids and other cephalopods, eschewing fish altogether. The case is suggestive of the old philosophical puzzle: Why is it that a live fish adds nothing to the weight of a bucket of water? and would be amusing but for the sad fact that the unfounded theory has already led to the killing of many of these graceful creatures.

The investigation of food-habits by means of stomach examination is of far-reaching importance. Dr. Merriam, whose letter on sea lions we print on another page, is engaged, through the Biological Survey, in the most elaborate study of animal foods ever made. For many years the stomachs of wild birds and mammals have been systematically collected and laboriously studied, to the end that the favorite and the occasional foods of each species in each season of the year, and in each part of the country, may become known. As each group is worked up the facts are published by the Department of Agriculture, and farmers and legislators are thus informed what species may properly be regarded as friendly, and what as hostile, to the interests of the people. In many instances it has been found that popular impressions, almost necessarily founded on a comparatively small number of facts, are altogether erroneous, so that war has been waged on our friends and protection given our enemies.

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*ON THE VITAL ACTIVITY OF THE ENZYMES.**

IN spite of the vast amount of work that has been done on the soluble ferments, since the discovery of diastase by Kirchoff, in 1814, the exact chemical nature of these substances is, perhaps, even more of an enigma to-day than the nature of albumen itself. Indeed, beyond the fact that the enzymes, or at least the greater number of them, are albuminous, that they probably belong to the group of nucleo-proteids and that they contain phosphorus, and probably iron, in addition to carbon, hydrogen, oxygen and nitrogen, we know but little more concerning their exact chemical composition than was known to Payen and

* In slightly different form this paper was read before the Cincinnati Section of the American Chemical Society, December 15, 1900.

Many of the biological memoirs referred to in the following were inaccessible to the writer in the original. He, therefore, desires to acknowledge his indebtedness to the following authorities: 'The Soluble Ferments and Fermentation,' Green; 'Die Fermente und Ihre Wirkungen,' Oppenheimer; 'The Cell in Development and Inheritance,' Wilson; 'Plant Physiology,' Sachs; 'Plant Physiology,' Pfeffer; Hueppe's 'Principles of Bacteriology,' Jordan.

Persoz in 1833, or to Bussy, when in 1840 he wrote that up to that time it had not been possible for him to obtain myrosin in crystalline condition. Apart from this uncertainty respecting their chemical composition, however, there has been a growing conviction in the minds of many most familiar with the peculiar and remarkable properties of these substances, that in the soluble ferments we have to deal with certain subtle and peculiar activities similar to those manifested by the living organism itself. The idea that the enzymes retain at least some vestiges of the original activity of the cell or organ of which they once formed a part is one that has appeared again and again in the scientific literature of the last twenty years with a curious persistency and under almost as many different guises as the proteid molecule itself is supposed to assume. According to Loew,* who was probably the first to advance any ideas of this kind, the enzymes are to be regarded as *active* or *labile* proteids or peptones, the activity of which is probably traceable to the presence of amido and aldehyde groups in the molecule, and whose instability is in some way connected with various molecular rearrangements involving these groups. He has also pointed out that many of the so-called protoplasmic poisons are just such substances as are known to readily attack amido and aldehyde groups in organic molecules, and it was in this connection that Loew first called attention to the silver reduction test as a means of distinguishing between active and inactive ferments and dead and living protoplasm. According to Loew† the conversion of the albumin of living into that of dead protoplasm presents a remarkable analogy to the transformation of an unstable substance into its stable modification. Such a transformation, for example, as is met with in the change of the yellow iodide of mercury into the more permanent red variety of this compound.

In the same way Medwedew,* like Loew, has found it necessary to assume that certain of the enzymes at least possess a residuum, as it were, of the vital forces of the living cell; and finally Armand Gautier† has gone even further in his assumptions and has taken the extreme view that the enzymes are to be regarded as *dissolved cells*, and that in addition to their other remarkable properties, they possess in common with other cells the power of assimilation and reproduction. Remarkable and suggestive as these ideas certainly are, they do not seem to have met with anything like general acceptance at the hands of biologists; indeed, in certain quarters, at least, they have encountered a very vigorous and decided opposition, and by some have been pronounced as far too vague to constitute even a satisfactory working hypothesis.‡ Apart from the fairness and justice of this criticism, there can be no doubt that, in his earlier work upon this subject, at least, Loew was inclined to lay too much stress on the silver reduction test as the basis of a sharp and accurate distinction between *active* (living) and *inactive* (dead) proteid; and while the terms *splinters of protoplasm* and *dissolved cells* may appeal very strongly to the poetical side of our nature, it cannot be denied that they are far too hazy to express with any sharpness of definition a scientific truth.

On the other hand, it would seem to the layman, particularly if he happen to be a chemist, that the whole trend of modern biology, until very recently at least, has been toward form rather than substance, and that all of the efforts of the biologist to

* Pflüger's Archiv., 27 (1882), 203, and 36 (1885), 170.

† Pflüg. A., 65, 249, 1897.

* Pflüg. A. 65, 249, 1897.

† See Effront, 'Les Diastases.'

‡ See Pfeffer's 'Plant Physiology,' 67, 69, 1900.

account for vital phenomena have been directed to the vital mechanism to the exclusion of the material substratum.

Indeed, it is not an uncommon thing to see the argument advanced that on account of their instability we can never hope to learn very much concerning the chemistry of those substances entering immediately into the composition of the living cell, for the reason that any attempt at their isolation from the cell contents at once results in their decomposition or permanent alteration. And yet the fact remains that even now at least fifty apparently distinct and different substances are known apart from, and independent of, the cell, which, in addition to some peculiar and characteristic property, such as the power to convert starch into sugar or split a fat into glycerin and a fatty acid, possess many of the more general properties and activities of the cell itself. These substances are the soluble ferments. In two very recent communications on the subject Bokorny* has given us some additional evidence of the sensitiveness of the enzymes and some additional reasons for believing in the inherent similarity between these substances and protoplasm. According to Bokorny, the sensitiveness of the ferments and their general similarity to protoplasm are to be observed in their conduct towards heat, light and the protoplasmic poisons. He therefore reaches the conclusion that the enzymes are substances similar to protoplasmic albumen, and that in all probability the two are only to be distinguished by the fact that the enzymes are wanting in organization. As the result of some recent work on certain aspects of enzyme action, the writer has been brought to see the necessity of these or similar conclusions from a somewhat independent standpoint; and, aside from their extreme instability and their delicate sensitiveness to their physical environment and to chemical reagents, the conclusion that the enzymes are active, in the sense of retaining certain of the vital activities of the living cell, would seem to derive considerable support from the following considerations:

First, their widespread and universal occurrence in all living things.

Secondly, their importance and necessity in metabolism.

Thirdly, their mode of origin.

Finally, in what follows it will be pointed out that the ferments exhibit a remarkably close analogy to the living non-nucleated fragments of the cell.

Since the discovery of diastase, in 1814, a large number of enzymes have been recognized, and what is of still greater interest and physiological significance, a large number of them, such as diastase, lipase, trypsin, etc., etc., have been found in both the vegetable and the animal organism, and, for that matter, in nearly every living cell. By means of diastase, starch is rendered available as a food-stuff both to the animal and to the plant. Trypsin occurs not only in the digestive fluids of the intestines, but is also found in the pineapple and the leaves and sap of the *Carica papaya*. The fat-splitting enzyme has been found not only in the pancreatic secretion, but also in the blood and liver and in nearly every organ and tissue of the hog. Its presence also has been proved in many seeds and seedlings. Myrosin, the mustard ferment, is found not only in the many species and varieties of Cruciferæ, but in many other natural orders of plants as well. Emulsin is another enzyme of the widest distribution in the vegetable kingdom. It has been aptly said, therefore, concerning the occurrence of the enzymes, that 'wherever life exists there also occurs the enzyme.' The one is the inseparable companion of the other. It is in connection with growth

*Chem. Ztg., 24, 1113–1114, Dec. 19, 1900; Chem. Ztg., 25, 1136–1138, Dec. 26, 1900.

and metabolism that the importance of the soluble ferments to the vital economy is seen to the greatest advantage. According to Thompson,* "The power of growth, of adding to itself substance of the same nature as itself, is the real mystery of living matter." So far as is known at present, it is mainly with growth that the enzymes are concerned. As a general thing they effect those changes which have to do with nutrition, *i. e.*, with the digestion and assimilation of food on the part of the organism. As a rule the enzymes bring about hydrolytic cleavages, the net result of which is to transform insoluble and non-absorbable reserve or food materials into absorbable and assimilable form. The transformation of starch into sugar, the change of inulin into levulose and that of cellulose into glucose, the hydrolysis of fats and the conversion of albumen into peptone, are all important and interesting examples of enzyme action. That the enzymes can also effect certain polymerizations and syntheses seems scarcely to admit any longer of a reasonable doubt; indeed, it seems not improbable, in the light of our present knowledge, that many changes hitherto looked upon as resulting from the vital activity of the living cell itself may in reality be accomplished through the instrumentality of a ferment.† Indeed it has been found that the soluble ferments stand in the closest possible relation to the vital activities of the animal and the plant. For example, Maquene‡ has recently pointed out that the predominating, if not the only, rôle in the conservation and development of seeds must be attributed to the enzymes, and that the causes which retard the alteration and activity of the enzymes tend to maintain the germinating powers of seeds, and that, when preserved under conditions favorable to the enzymes remaining inactive, seeds may be kept indefinitely.

In this connection Sachs* long ago pointed out that the so-called dormant periods of seeds and buds are probably intervals during which the necessary ferments are being produced in the cell. The vital relation of the enzyme to the living cell is also indicated by the fact that the ferment is often produced by the cell to meet some new necessity arising from a change in external conditions or environment. For example, it has been found that the molds produce no diastatic or proteolytic enzymes so long as they are freely supplied with sugar. When cultivated on an albuminous medium, however, they speedily develop a proteolytic enzyme and on starch they soon produce diastase, and in the same connection Bernard has observed that the larva of one of the common flies, *Musca lucilia*, contains a large amount of glycogen, but no diastase. As soon as the larva passes into the chrysalis stage, however, where the glycogen is required, a diastatic ferment at once makes its appearance.

Apart from the production of several of the enzymes from their corresponding zymogens by the action of dilute acids, no enzyme has ever been produced outside of the living cell. In this connection it will be recalled that the zymogens are the mother substances of the ferments and that they in turn have never been produced outside of the living cell. In the light of these facts, the mode of origin of the ferments becomes a matter of considerable interest and importance. It has been proved that just as the nucleus and cytoplasm both participate in the formation of new cells by cell-division, so also both participate in the

* 'The Study of Animal Life,' J. A. Thompson, p. 138.

† See the work of Croft Hill 'Reversible Zymohydrolysis.'—*Jour. Chem. Soc.*, London (1898), Trans., 634. Also, the work of Kastle and Loevenhart on the Synthesis of etheyl butyrate by lipase.—*Am. Chem. Jour.*, XXIV., 491–525.

‡ Ann. Agron., 1900, 26, 321–332.

* Sach's 'Plant Physiology,' 1887, p. 352.

formation of the zymogen granules, and that these, in turn, ultimately give rise to the soluble ferments. In this connection, it might be well to recall the interesting histological investigations of Heidenhain on the pancreas of the dog during the different phases of nutrition. In the case of a dog that had been fasting for a little over one day, each cell of this gland was seen to consist of two zones. The inner zone, abutting on the lumen of the alveolus, was observed to be much the larger of the two and to be thickly studded with fine granules, while the outer one, towards the basement membrane, was narrow and its substance clear and homogeneous. The nucleus of the cell was observed to be considerably shrunken and corrugated and to lie at the border of the two zones. In a pancreas of another dog, that had been killed during full intestinal digestion, the same two zones were visible. The inner granular zone, however, was much contracted and the granules much less numerous, whereas the outer hyaline zone was much wider. The cell, as a whole, had become smaller, the nucleus had regained its spherical shape and was situated near the center of the cell. These changes in the cells were observed to repeat themselves during the several phases of digestion. In the same manner other observers have been able to demonstrate a close connection between the degree of granularity of the cell and the amount of enzyme secreted. In studying the secretion of diastase by the scutellar epithelium of germinating barley, Brown and Morris were able to determine that when the secretion of diastase had ceased the marked granularity of the cells had also disappeared, and, what was even more remarkable, the nucleus of the cell had disappeared also. It would seem, therefore, that for each enzyme there exists in the gland cell a distinct antecedent substance or zymogen, ready to be transformed into the ferment the moment the latter is required. That these zymogens are not enzymes has been proved by Langley, for pepsin at least, in the most masterly and convincing manner; and the same thing has been shown for other zymogens by other equally competent observers.

The most important histological studies on the formation of the zymogens have been made by Macallum. By employing nuclear stains he was able to make out that during the formation of the zymogen a part of the chromatin of the nucleus was extruded into the cytoplasm of the cell in the form of a substance which he calls prozymogen. On coming into the cytoplasm it unites with some component thereof, as the result of which combination the granules of zymogen are produced. These granules were observed to gradually increase in size, apparently at the expense of some substance in the cytoplasmic portion of the cell. It will be observed that Macallum's view of the formation of the zymogen granules enables us to understand the shrinking and disintegration of the nucleus during secretion. It should be borne in mind, however, that in the formation of the mother substance of the ferment both nucleus and cytoplasm supply their quota.

This view of the formation of the zymogens strongly supports the conclusion that the enzymes retain a part, at least, of the original activity of the living protoplasm. In the formation of a new cell or an individual, the cell nucleus and the cytoplasm, of either the same or different cells, are involved. We have just seen, however, that in the production of the zymogen granules both the nucleus and cytoplasm participate. If, therefore, we look upon the cell nucleus as the formative and directive force in the one case, it would seem logical to so regard it in the other, the only difference being, that while upon the one hand its energies go to the forma-

tion of a new cell, on the other, they are consumed in the synthesis of an exceedingly active compound. So that scrutinize the matter as carefully as we may, we are able to see no break or discontinuity anywhere between protoplasmic activity on the one hand and the activity of the enzyme upon the other, and, originating as they do, it would be very strange indeed if the enzymes were found to be inactive substances. In this connection Langley's view on the relation of pepsin to the gland cells is highly suggestive. He says, I conceive the matter thus: "The protoplasm of the gland cells does not at one swoop form zymogen as it occurs immediately previous to its conversion into pepsin, but forms certain intermediate bodies in which the zymogen radicles become more and more isolated. Since the zymogen contains the radicle of the ferment, the ferment will be obtained with greater difficulty from the imperfectly elaborated zymogen, *i. e.*, as we ascend from the final meso state to protoplasm, the ferment will be split off less and less readily. The last traces of the ferment, then, which are obtained by repeated extractions, I take it, arise from substances which are on the way to be converted into zymogen.''* From such clear and beautiful reasoning it is but a short and logical step to the modern view of Reynolds Green,† who sees in the power to produce fermentation a fundamental inherent property of protoplasm; and who sees in the secretion of a particular enzyme 'a mark of differentiation within the living substance, just as in the slow movements of amœboid protoplasm we recognize something which in the higher and more differentiated organism appears as the contraction of muscular fiber.'

The general conduct of the enzymes is such, therefore, that if, in addition to their other properties, we could invest them with morphological characteristics and with the power of growth and reproduction, even the most conservative would, I take it, be inclined to place the soluble ferments in the category of living things. If they possess morphological characteristics, however, these are beyond the reach of the highest magnifying powers in our possession to-day; and while the enzymes exhibit certain recuperative tendencies,* they have never been made apart from the zymogen granules or the living cell, and while in perfectly dry condition they are fairly stable under ordinary conditions, their solutions speedily deteriorate, and only in a very few instances has there been observed any spontaneous

* 'The Soluble Ferments and Fermentation,' Green, p. 384.

† 'The Soluble Ferments and Fermentation,' Green, p. 371.

* The tendency on the part of the enzymes to regain their activity after they have once lost it, for any cause, is very suggestive in the light of these considerations. Bussy in his investigation of myrosin long ago pointed out that after the activity of this ferment had been destroyed by small amounts of ether or weak acids it regained the same by remaining in contact with water for 24 to 48 hours.—*Liebig's Ann.*, 34 (1840), 227.

In like manner Bokorny has found that a 0.01-per-cent. solution of formaldehyd renders malt diastase inactive for 24 hours without destroying the enzyme altogether.—*Chem. Ztg.*, 24, 1113–1114, 19/12, 1900.

Quite recently Hanriot has observed that serum lipase is rendered inactive by small amounts of free acid. After neutralization, however, the ferment regains its activity. He concludes, therefore. that the acids first combine with the enzyme to produce substances no longer capable of hydrolyzing fats, and that upon neutralization these compounds are decomposed and the ferment regenerated.—*C. R.*, 132, 146–149.

In this connection it is further interesting to note that by treatment with caustic potash Scholl was able to partially restore to blood serum the antiseptic powers which it had lost as the result of heating. At present the germicidal property of serum is believed to be zymotic. Hueppe's 'Principles of Bacteriology.' —*Jordan*, p. 86.

It is further interesting to note in this connection also that during life protoplasm shows a faintly alkaline reaction. Hammarstan's 'Physiol. Chem.' Also 'Lehrbuch der Physiol. Chem.' Neumeister.

increase in the activity of such solutions. Outside of the living cell, therefore, these substances do not seem to be able to grow or to reproduce.

In this connection it has occurred to the writer that the enzymes sustain about the same relation to the living cell as do the non-nucleated cell fragments. It has been proved as the result of numerous observations that, if a unicellular organism be subdivided by mechanical means, each fragment thereof will still manifest vital activity. To the biologist, all these fragments are alive and yet their ultimate fate may be very different. Those that are nucleated have been found to have the power of completely repairing their injuries and ultimately develop into complete cells again and reproduce by cell-division. On the other hand, while the non-nucleated fragments frequently retain their vitality for days, for example, non-nucleated fragments of the amœba have been known to live for fourteen days, they ultimately perish. In some cases the non-nucleated fragments may even heal their wounds and engulf food particles; the latter, however, remain undigested and the fragment ultimately dies without reproduction. In this connection Verworn has pointed out that a nuclear fragment entirely devoid of cytoplasm can no more regenerate the entire cell than can the non-nucleated cytoplasm alone. He is, therefore, of the opinion that the formative energy of the cell cannot derive from either the nucleus or cytoplasm alone, but from both. To him the cell itself, and not merely the nucleus, is the vital unit, the activities of which are contributed to, in part at least, by both the nucleus and the cytoplasm, and that numerous exchanges of material actually go on between them is supported by the most trustworthy histological evidence of the present day. We see thus that in the formation of a new cell, whether by the natural repair of a cell fragment or by the usual process of reproduction, both the cell nucleus and the cytoplasm are concerned. It has also been shown, however, that both the nucleus and the cytoplasm are concerned in the production of the zymogens and ultimately of the ferments. It would seem, therefore, that the enzyme and non-nucleated cell fragments stand in essentially the same relation to the living cell. Both originate in much the same manner, both lack the power of growth and reproduction, and yet both exhibit certain vital activities. Would it be far from the truth, therefore, to look upon the enzyme as the chemical basis of life?

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*THE PROGRESS MADE IN ENGINEERING DURING THE NINETEENTH CENTURY.**

THE progress made in engineering during the nineteenth century, on the one hand, furnishes in itself a reminder of its ultimate dependence upon mathematics and the sciences, and, on the other hand, it attests the fact that its great and growing inspiration has been the welfare of all the civilized world. A hundred years ago but little of engineering worth or prominence was in existence; so little, comparatively, that a glance at contrasting conditions then and now will reveal striking differences.

A century ago traveling in its highest development was limited on land to the horse and coach, covering perhaps a wearisome fifty miles in a day; now a day's travel is eight hundred miles. Then, a trip from New York City to Philadelphia consumed as much time and occasioned more fatigue than one from New York to St. Louis now; or a journey then from New York to St. Louis consumed the greater

* Read before the Academy of Science of St. Louis on February 18, 1901.

part of a month at best and was considered a greater hardship than a journey to India or China now. Then, the wind furnished the sole motive power for the ships of the ocean, and a voyage took as many weeks as now it does days. A hundred years ago the great canals were not built (one making the route to India as short as was formerly the distance to the half-way point—the Cape of Good Hope); nor monolithic lighthouses erected along the coasts for the safety of ocean voyagers. Then a building three stories in height was unusual; now a sixteen-story building is not uncommon. The century has seen the chaise give place to the horse-car and this to the cable, and finally the electric car with its speedy service brings the office within easy reach of the suburban residence.

The military engineer, while still trained and ready to engage in the fiercest shock of battle, has also developed plans of hasty works to accelerate transportation and the march, to make practicable the temporary entrenchments of the battlefield or the more permanent works of encampment and the siege; and he has perfected to a high degree the many stupendous works of permanent fortification and defense. While in the preceding century architecture was considered a branch of engineering,* yet in the century just closed they have been definitely divorced.

The mine engineer has developed methods and perfected details, until the total yield of mineral wealth now each year exceeds a thousand millions of dollars, while a hundred years ago it was but a modicum. Copper has been needed for electric purposes and the arts, and he has driven adits and shafts, drifts and tunnels, until some regions are honeycombed in the search for the metal to depths exceeding a mile. The same watchful enterprise characterizes the search for other metals. But by far the most important products of the mine are coal, devoting over seven hundred million tons a year to the countless uses of commercial and industrial life, and more than seventy million tons per annum of iron and steel, whose services in the century's developments are preeminent.

The marine engineer has developed not only the speed of ocean vessels as noted, but their safety and size as well, developing a marvel of steel construction that will contain the lading of a score of barks of a hundred years ago and carry a small city of people across the seas with a safety all but perfect. Less than a hundred years ago the first successful steamboat was built, of 4 H. P. and steaming at a rate of seven miles per hour; now the tonnage of our great steamships reaches 16,000, with a H. P. of 37,000, a length of more than seven hundred feet and a speed of twenty-seven miles per hour, while some military steamboats attain an hourly speed exceeding forty miles. A century ago the tonnage of steamships was naught; now this yearly addition to the commerce of the world is more than two million tons. Since the days of the *Clermont* and the *Savannah*, the marine engineer has been applying new discoveries and evolving improvements, slowly at first and then with increasing success, until the perfected steel giants of to-day cost about four million dollars each, instead of twelve thousand dollars for the sailing vessel of a century ago. And now there are more than fourteen thousand steamships in the world aggregating nearly twenty million tons register—a great world's fleet that, steaming abreast, would cover a width of a hundred miles.

The electrical engineer, within the latter portion of the century, has developed a field felt in all phases of practical progress, ranging from the inauguration of the telegraph of the mid-century and the submarine cable

* *Vide* 'Science des ingenieurs,' Belidor, Paris, 1729.

of about forty years ago to the enormous electric stations, furnishing power for our expanding industries, turning night into day in our cities and making practicable the great development in electric traffic in urban districts, electric elevators in our stores and electric apparatus of infinite variety everywhere to minister to our needs and comforts. Through the electric transmission of power has a vast field of industry been opened. Through all the ages had great water power been useless because of its remoteness, until the development of electric machinery, suited to the purpose, made practicable the transmission of power, twenty, thirty, forty miles, with much greater distances in prospect. As indications of the inevitable result, witness the busy life in the new cotton mills of the Piedmont regions of the Southern States, or the quickened industries of the Pacific Coast.

The mechanical engineer had invented the steam engine before the beginning of the century just closed, but its development was crude, as shown by the winding and pumping engines, the sun and planet, and beam engines placed in South Kensington Museum to illustrate the practice of that day, engines which were then considered unusual if they developed one two-hundredth part of the power of engines of to-day; while the total for the world is now not far from seventy million horse-power, which is greater than the aggregate physical power of the total population of the world, even were it possible to exert this power without cessation. And the engine is only one instance of the unparalleled advance; we should also mention such inventions and developments as the cotton-gin and cotton-bailing machinery, the gas and oil engines, the harvester, the sewing machine, the hydraulic press and other hydraulic machinery, the steam-hammer, and countless other labor-saving, epoch-marking machines of wide import and far-reaching significance, like the printing press, capable now of printing, folding and counting 1,600 eight-page newspapers per minute, where the hand-press a century ago could make not more than four or five impressions in the same length of time.

The metallurgical engineer has added his full share to the increased productive capacity of the world. A hundred years ago only a pitiful modicum of iron and steel was produced, and this with great expense and almost infinite pains. The blast furnaces then were about one-half their present diameter and one-third the height, producing perhaps five thousand tons per annum, where furnaces now will produce thirty to forty times that amount. Wrought iron was produced by the Bloomery, Catalan or other crude direct processes, or by the direct open-hearth fineries of Sweden or Wales; and steel by the Catalan, cementation or crucible steel processes, likewise very expensive and slow. At the present day we have, for the production of pig iron, blast furnaces a hundred feet high, costing seven hundred thousand dollars each; and for the finished product we have the puddling furnace (first introduced by Cort close to the end of the eighteenth century), producing malleable iron, and the Siemens open-hearth and the Bessemer processes (developments of the last half-century) for the production of steel. These last two inventions mark the greatest advance ever made in metallurgical processes, and have made possible the wide range in construction in steel in all the various branches of engineering. Figures are wanting to give the quantity of steel produced a century ago. It could not have exceeded a hundred thousand tons, for fifty years ago Sheffield, then the great steel-producing city of the world, manufactured about fifty thousand tons per year; and the cost of crucible steel, made from Swedish iron, worth sev-

enty dollars, was two hundred and fifty dollars per ton. Now steel is produced at less than thirty dollars; single steel firms produce millions of tons each year, and the annual product of the world is nearly thirty million tons. To show the great growth of this interest, Sir Henry Bessemer illustrated the total production of Bessemer steel of the world by saying that if the product of a single month were made into a solid shaft of one hundred feet diameter it would reach 557 feet high. This illustration of the world's production eight years ago is now equally applicable to the United States alone, nor does it include the production of open-hearth steel, or wrought or pig iron, the total for the world approaching eighty million tons annually. There is hardly any personal, municipal or corporate life, or hardly an enterprise of war or peace, that has not more or less closely connected with its development the use of this remarkable engineering material.

In the domain of the civil engineer progress is none the less marked. Within a score of years there has been developed the tall office and other buildings of the steel skeleton type, where the engineer has had to so design the steel frame that it will support sixteen, eighteen or twenty stories, crowded with busy life and industry, as well as to bear the weight of the walls and the great wind pressures that such high buildings sometimes must sustain; and not only this, but he has so considered and controlled methods and materials in the design and in protecting this all-important steel skeleton from fire that the occupants are safer in them than in the older style of building. Steel bridges have had a longer reign, though less than forty years ago it was considered a very remarkable feat to build an iron bridge whose length of span was 320 feet. Thirty years ago the magnificent steel-arch bridge of our own city, consisting of three spans, with the central one 520 feet in length, was erected by Captain Eads. Twenty years ago the Brooklyn suspension bridge, of 1,600 feet length of span, was being constructed. Ten years ago the great cantilever bridge across the Firth of Fourth was built, containing two spans of 1,710 feet each. And now there are plans, perfectly practicable, for a suspension span of 3,200 feet, to carry eight railway tracks across New York harbor and to weigh between sixty and seventy thousand tons. In railway affairs the engineer has perfected the problems of transportation as we have seen, until the total mileage of the century is great enough to girdle the world fourteen times. In questions of water supply and sewage all our cities provide systems as a necessity, where a hundred years ago they were the luxuries of the very few, and woefully inadequate at that; and the engineer and the biologist have been colaborers in developing successful methods of preventing danger of contagion from these public utilities. Harbors and docks have been constructed and improved consonant to the spirit of the age. Foundations for great bridges and towering buildings are carried to depths requiring methods and inventions of particular resourcefulness, including the famous pneumatic processes. The development of hydraulic principles has made possible a varied series of achievements of far-reaching significance. Irrigation enterprise, which had been dead for centuries in its ancient home and was dormant even in India, has spread over the arid regions of the globe and is making oases of the waste places of the earth. In only two-thirds of the year one of the small canals of the century transports merchandise of a greater value than have the imports of China, for which the great world powers are so strenuously alert. The construction of the proposed canal from ocean to ocean across Central America will be a stupendous undertaking; humanity has never ceased to

marvel because of the great pyramids, and they have always been considered one of the wonders of the world; but, reckoned at the present cost of masonry, a dozen such pyramids could be built for the expense involved in the Nicaragua Canal. And when it shall be built the engineer may well improve the great waterways of the interior and build fleets of steel barges that can withstand the sea, so that our products can be sent without transhipment from our inland cities to the western coasts of the Americas. Another product of the century of significant import is Portland cement. With the aid of the chemist this material has been so improved and made accessible that now the artificial stone made from it is most widely used and is superior to most natural ones. Furthermore there is the unequivocal indication that, in combination with the all-important steel, many classes of structures of superior characteristics will be designed. Already there have been built many steel and concrete bridges which are a hundred feet in span and more, and for the Memorial Bridge at Washington, maximum spans of this construction are planned to be 192 feet each in length; while the engineer who designed it considered perfectly practicable an alternative plan of similar arches 283 feet in length. Arches of such majestic span are among the imminent constructions of the engineer.

A half-century ago Macaulay said, "Those projects which abridge distance have done most for the civilization and happiness of our species." And yet, since then, transportation facilities have increased many-fold, the first ocean cable had not been laid, nor was the telephone in use, nor other distance-annihilating inventions made. The attainment of results both definite and valuable has been in constantly accelerating ratios through all the broad field of endeavor which marks the domain of the engineer, viz., the 'direction of the great sources of power' and the development of the boundless resources of materials in nature to the use and convenience of mankind. The effect and value of this art pervade all lines of human interest and of contact, whether following Macaulay's idea of potentially bringing peoples nearer together or in the way (largely developed since his day) of rendering it possible to make life more thorough and intense by the concentration of power and of effort in great centers of activity, which is made possible by engineering structures and developments such as the towering office and industrial buildings of the last score of years; the tremendous concentrated power in steam and electric machinery of the present; the penetrating circulation of life-bringing, waste-removing water, ministering to our cities as does the blood to the body; and other examples of almost infinite variety which would cause amazement were they not so common now.

The glory and the power of the civilization of to-day result from the concentration of forces, both human and material, commanding the resourcefulness of mankind, applying the principles and discoveries of pure science, and developing the resources of nature for this purpose; and such is the degree of successful adaptation already reached, that the span of life of man potentially surpasses the millennial existences of legendary times. 'Better fifty years of Europe than a cycle of Cathay.' And the crowning glory of the measure of achievement thus far reached is that its inspiration is the welfare of the race.

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MONAURAL LOCALIZATION OF SOUND.

IN the *Psychological Review* for May, 1901, occurs a detailed account of an investiga-

tion conducted by Dr. Warner Fite and the present writer upon the capacities of auditory localization in a man totally deaf in one ear. The readers of SCIENCE may be interested in a brief statement of the essential facts observed.

The subject of the experiments is a man of thirty, who lost his hearing in one ear during early childhood, as the result of scarlet fever. The present symptoms, as reported by expert clinical test, indicate total nerve-deafness and consequently lesion of the labyrinth. The drum membrane was originally destroyed by ulceration of the middle ear and a scar has now replaced it. The precise condition of the bones of the middle ear cannot be determined. The malleus appears to be intact. The uninjured ear is decidedly more acute than the average, but in no such degree as would warrant the term hyperesthetic.

Without entering into details, the apparatus employed in the experiments may be described as consisting of a mechanical device, whereby noises and tones may be given in various directions and at a constant distance from the subject's ear. The arrangement permits the exact registration, in connection with the surface of an imaginary sphere, of each location from which a sound is given. The instrument permits all the adjustments to be made noiselessly, so that the subject, who keeps his eyes closed during the experimentation, receives no suggestion whatever of the direction from which the sound proceeds. The stimuli used consisted of tuning fork tones, the tones of a Galton whistle and the snapping sound made by sending an electric current through a telephone. The tones of the forks are practically pure. The notes of the whistle are more complex and the noise of the telephone is highly complex, containing a large number of partial tones.

It will facilitate a succinct statement of the results to imagine the subject seated in the center of a large clock dial placed horizontally. The figure twelve is directly in front, the figure six behind, three is opposite the right ear and nine opposite the left ear, which is deaf. The sounds of which we shall speak first are given at the height of the ear.

Pure tones are almost, if not wholly, unlocalized by this subject. Often he can assign no position whatever to such tones, and, when he does hazard a location, the percentage and character of error show that the process is extremely inaccurate. On the other hand, complex sounds are localized with an accuracy which follows closely the number and audible nature of the partial tones they contain. The one exception to this is the region lying between eight and ten on the face of our illustrative dial. This is the region immediately opposite the deaf ear. To offset this defect the discrimination between positions immediately in front and those directly behind is superior to that of normal persons, for whom this distinction is notoriously uncertain. For the remaining regions, from ten toward the right around to eight, the localizations are only slightly inferior to those of normal individuals. Occasional confusions of the right and left hemispheres occur, which are almost unknown to binaural hearing. But in general, both as regards the character of the error and as regards the amount, the localizations are surprisingly like those of the binaural type.

In normal persons the localization of sounds is commonly supposed to depend upon the differences in the stimulations reaching the two ears. These differences are describable as partly differences in intensity and partly differences in quality. Thus, a sound opposite the right ear, for example, stimulates that ear more intensely than it does the left ear, and, if it be a complex sound, more of its component overtones will be noticeable to the right ear

than to the left, so that qualitatively it will be perceived as different from the same sound when heard directly in front. In the case of monaural hearing it is clear that the intensity of a sound can afford only the most ambiguous information. An apparent change in intensity in such a case may mean change of distance, change of direction, change of actual intensity or some combination of these alternatives. But the single ear is by no means so helpless as regards the detection of qualitative differences due to changes of direction. Our subject himself connected his capacity to localize sounds with this noticed change in quality. His results show that (although in every case he remained ignorant of his success or failure during the experimentation) he possessed to begin with a relatively accurate auditory orientation on the basis of these qualitative peculiarities of sounds due to their direction, and, furthermore, that after gaining a little familiarity with the sounds, his localizations became very accurate. Nor did he seem to find any serious difficulty in determining direction, when the absolute distance of the sounds was varied, nor yet when the absolute intensity was varied. Pure tones he could not localize for they undergo no qualitative modifications by change of direction. Intensity changes are the only ones of which they are susceptible. Slightly complex sounds he can localize fairly. Highly complex sounds, possessing component tones well inside the range of ready detection, he can localize extremely well, save in the region just opposite the deaf ear. The same statements hold for localizations above and below the equatorial plane, to which we have confined our description. The modifications met with outside this plane are all conformable to the fundamental theory of the dependence of the localizations upon qualitative differences in the sounds. The pinna, the meatus, the bones of the head, etc., all contribute to the production of these qualitative modifications.

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FOOD OF SEA LIONS.

THE California State Board of Fish Commissioners during the past two years has taken steps to kill off a very large number of sea lions on the California coast, on the ground that these animals are highly destructive to the salmon fishery. The president of the board, Mr. Alexander T. Vogelsang, claims that it is not the intention of the board to exterminate the sea lions, but merely to kill '10,000 of the 30,000 that now infest our harbor entrance and contiguous territory.'* The opinion of observers familiar with the sea lion rookeries is that the number of animals has been greatly exaggerated, and that long before Mr. Vogelsang has killed the contemplated 10,000 there would not be a living sea lion left on the whole coast. Already many have been killed and, unless public sentiment is aroused to check the movement, some of the most interesting rookeries of the State are in danger of depletion. The Fish Commissioners have employed men to shoot the sea lions, and are loud in their lamentations because the Government light-house reservations have not been thrown open to the slaughter.

The local fishermen, the State Fish Commission and others assert without qualification that the sea lions feed extensively on salmon, and the inference from their statements is that the animals subsist chiefly, if not entirely, on fish. A few years ago, when similar complaints were made against the fur seals, I took the trouble to examine the stomach contents of a large number of these animals, and found to my surprise

*In letter to Hon. Lyman J. Gage, Secretary of the Treasury, dated San Francisco, June 3, 1899.

that the great bulk of their food consisted of squids, hundreds of whose beaks and pens were found in the stomachs, while in only a few instances were any traces of fish discovered.

In 1899, a well-known naturalist, Prof. L. L. Dyche, of the University of Kansas, spent the months of June, July, August and September on the California coast, at a time when the sea lions were being slaughtered in the alleged interests of the fishermen. Professor Dyche became interested in the question of their food, and took the trouble to examine the stomachs of 25 sea lions, not one of which contained so much as a trace of fish. The region visited extends from Monterey Bay southward along the coast for about 25 miles.

Between June 25th and July 16th, there were washed ashore within three miles of Point Pinos, at the mouth of Monterey Bay, eight sea lions which had been shot, the fishermen said, because they were feeding on salmon. Professor Dyche examined the stomachs of all of these and has given me a detailed record of the contents of each. It would take too much space to print this in full. Suffice it to state that the remains of squids and cuttlefish (*Octopus*) were found in all, and that several were filled with large pieces of the giant squid. Notwithstanding the fact that at the same time and place salmon were being caught by fishermen, not a fish scale or bone was detected in any of the stomachs. Whenever possible Professor Dyche opened the stomachs in the presence of the fishermen, who invariably expressed the greatest surprise at the result. On July 20th, Professor Dyche moved his headquarters southward and established a camp about twelve miles below Monterey Bay, between Point Carmel and the lighthouse, near which is an extensive rookery of sea lions. Between July 20th and August 16th, the stomachs of seventeen additional sea lions were examined. Eight out of the seventeen were well filled with the flesh of the giant squid; two were gorged with large octopus, while the remaining seven contained pens and beaks of squids, the quantity varying from half a pint to about a quart.

Professor Dyche was told that there were no fish within two or three miles of the sea lion rookeries near his camp, as the sea lions had caught or driven them away. In the face of this statement, he himself caught a dozen rock cod one morning between shore and the seal rocks, and his boatman, George Carr, an old salmon fisherman, caught plenty of rock cod weighing from one to eight pounds each, within sixty feet of the flat rock where from one to 300 sea lions landed each day. The water close to these rocks, where the sea lions had lived for ages, proved to be the best fishing ground in the locality. Professor Dyche states further that he landed a number of times on the rocky islands where in places the excrement from the sea lions formed a layer a foot thick. He hunted through this for fish bones and scales, without being able to discover a single one. On the other hand, the tough pens from the backs of the squids were abundant.

Professor Dyche found the fishermen loud in their denunciation of the sea lions on account of their alleged destruction of salmon, but, although he was on the fishing grounds continuously for more than three months, the fishermen were unable to show him a single instance in which a sea lion had killed a salmon. He adds, "You can hardly imagine the surprised look on these fishermen's faces when they saw the great masses of squid meat roll out of the sea lions' stomachs when cut open."

The fact that sea lions in captivity will eat fish rather than starve has little bearing on the question, and the additional fact that salmon in nets are sometimes found bitten off or eaten is by itself no evidence

at all, particularly in places where either sharks or otters occur.

It is not claimed that sea lions in their native element never eat fish; at the same time the only actual evidence we have on the subject fails utterly to substantiate the allegations of the fishermen. On the contrary, all of the twenty-five stomachs of sea lions examined by Professor Dyche contained remains of squids or cuttle fishes, and not one contained so much as the scale or bone of a fish. And is it not significant that in former years, when sea lions were much more plentiful than now, salmon also were vastly more abundant? If the fishermen will look into their own habits and customs during the past twenty-five years, it is believed that the cause of decrease of the salmon will not be difficult to find, and this without charging the decrease to the inoffensive sea lions, whose rookeries constitute one of the greatest attractions to the visitor on the California coast.

C. HART MERRIAM.

SCIENTIFIC BOOKS.

The Seri Indians. By W J McGEE. Extract from the Seventeenth Annual Report of the Bureau of American Ethnology. Washington, Government Printing Office, 1898 [1901]. Pp. 344, with 62 plates, and 42 figures in the text.

Seldom has one to chronicle the appearance of a work so thoroughly 'a contribution to human knowledge' as is this modestly titled essay. Brinton, in his 'American Race' (N. Y., 1891), styles the Seris 'a Yuma folk,' and consecrates a few lines to the enumeration of their not very prepossessing characteristics. Indeed, although these Indians came into contact with the whites in 1530–1540, they remained till towards the close of the nineteenth century perhaps the least studied of all the North American aborigines. The expeditions sent out in 1894 and 1895 by the Bureau of American Ethnology, under the efficient leadership of Dr. McGee, have resulted in the shedding of a flood of light upon one of the most interesting and remarkable groups of savages on the globe. After a brief introduction dealing with the salient features of the people, geographical nomenclature, etc., come sections on habitat (pp. 22–50), summary history (pp. 51–122); tribal features—nomenclature, external relations, population (pp. 123–135); somatic characters—stature, color, etc., skull, skeleton, pedestrian habit, fleetness and endurance, absence of 'knife sense,' race sense, cheirization, alternation of states (pp. 136–163); demotic characters—symbolism and decoration, industries and industrial products, social organization, language (pp. 164–344). Throughout these pages one is made aware of that noteworthy combination of keenness of perception and aptness of expression, that harmonious unity of the explorer and the recorder, which make the author's anthropological publications rank with the most suggestive and most stimulating scientific literature of the day.

The Seris (the word is Opata and means 'spry'), or, as they call themselves (by a name including fire and the animal world) *K^{m} káak*, 'our-great-mother-folk-here,' inhabit Tiburon Island (some 30 miles in length by from 12 to 20 in width) in the Gulf of California, and a limited adjacent area on the mainland of the Mexican State of Sonora. Two centuries ago they are said to have numbered several thousands, but almost uninterrupted warfare has reduced them to some 350, of whom not more than 75 are adult males or warriors; and, notwithstanding the fact that, under the renewed isolation of the last decade or two, they seem to have rallied their strength a little, or at least to have held their own, Dr. McGee holds out to us no other prospect than the 'early extinction of one of the most strongly marked and distinctive of aboriginal tribes.' In the historical summary the chief events in the contact of Caucasians and Seris, with their terrible results, in so far as the latter are concerned, are outlined, the concessions (now reported) of Seri territory to American speculators may be the beginning of the end. If so, the Seris will not have passed away without meeting an able and sympathetic chronicler. The importance of Dr. McGee's monograph for those engaged in the study of the phenomena of heredity and

environment, of somatic and mental relationship, of tribal and individual expressions, of isolation and *Wanderlust*, of race antagonisms and human affections, of labor and repose, of the matter-of-fact and the mystical, can hardly be exaggerated, since, as he claims, with seeming justice, 'the Seri must be assigned to the initial place in the scale of development represented by the American aborigines, and hence to the lowest recognized phase of savagery' (p. 295). The environment of the Seris consists of the broad Desierto Encinas (the eastern boundary), the mountainous zone of Sierra Seri, Tiburon Island (with adjacent islets), the navigable straits and bays about the islands and the mainland. The mainland is a sort of a dependency, for Tiburon Island (the eastern shore especially) is the real home of the Seris. To their dwelling chiefly on the prolific seashore of Tiburon Dr. McGee attributes the fact that the Seris 'never learned the hard lesson of desert solidarity,' and so have 'held aloof from that communality of the deserts which has brought so many tribes into union with each other and with their animal and vegetal neighbors through common strife against the common enemies of sun and sand—the communality expressed in the distribution of vital colonies over arid plains, in the toleration and domestication of animals, in the development of agriculture, and eventually in the shaping of a comprehensive solidarity, with the intelligence of the highest organisms as the controlling factor' (p. 133). The isolation of the Seris is reflected in their enmity towards aliens—the Papagos, the Yaquis, the Caucasians—an enmity which removes them in thought and life from all contemporaries so that 'they far out-Ishmael the Ishmael of old on Araby's deserts.' The local antipathy is even greater than the race antagonism for the whites, who have been sometimes tolerated for a time as food-bringers or wonder-workers. This antagonism amounts to obsession, and is 'crystallized into a cult'; yet among themselves, we are told, 'they were fairly cheerful, and the families were unobtrusively affectionate'—maternal affection, especially, is strong.

The waters about Seriland, as some of the Spanish names—El Infiernillo, Sal-si-puedes, etc.—indicate, are very stormy and dangerous to navigation, but 'the fierce currents and frequent storms of the region * * * have undoubtedly contributed to the development of the peculiarly light, strong and serviceable water-craft [balsas] of the aboriginal navigators among the islands' (p. 45). The primary resource of Seriland is potable water, and the springs and water-holes are few and far between. Yet it is the tribal policy (based perhaps on military instincts) to 'locate habitations in places surprisingly remote from running water' (p. 183). This has naturally developed the water-industry, and it is not strange that the Seris 'are essentially and primarily water-carriers, and all their other industries are subordinated to this function.' As remarkable as their conquest of the stormy sea is the Seri invention of an olla or water-jar, which, in so far as capacity is related to weight of vessel, is about twice as economical as the corresponding ware of the Pueblos or the Papagos. These Indians seem to have conquered the desert also in this respect. The basketry of the Seris is likewise of very noticeable lightness.

Among the most striking physical characteristics of the Seris are 'the noble stature and erect yet easy carriage,' the dark color of the skin, breadth and depth of chest, 'slenderness of limbs and disproportionately large size of extremities (especially the feet),' long and luxuriant hair, and 'a peculiar movement in walking and running.' But a single Seri skeleton has been scientifically studied, and the details of the measurements, as given by Dr. Aleš Hrdlička, occupy pages 141–147 of the work under review. The skeletal facts confirm the deductions from the living body as to the slowness of the organism in attaining maturity—somatic growth continues 'throughout an exceptionally long term in proportion to other stages in the life of the individual.' The range of variation in stature, color, etc., is less than is the case with neighboring Indian tribes. The segregative habit and antagonism to aliens—'protean manifestations of race-pride'—amount to what Dr. McGee calls *race-sense*. Indeed, the Seri are so close to each other and so far from all others that a member of the tribe 'can no more

control the involuntary snarl and growl at the approach of the alien than can the hunting dog at sight or smell of the timber-wolf' (p. 155). The pedestrian habit and the adaptation of the body in its movements (simulating almost the antelope) to the needs of progression in a particular environment, are quite remarkable, and the skill of the Seri runners, like their swiftness of foot, is almost incredible—in men, women and children, the pedestrian art is highly developed. Another conspicuous peculiarity of these Indians is 'habitual use of hands and teeth in lieu of the implements characteristic of even the lowly culture found among most primitive tribes.' They practically lack the 'knife sense,' and are, moreover, conspicuously unskilful in all mechanical operations involving the use of tools. Seri warriors are said often to have recourse to tooth and nail in battle.

Except face-painting, which is practically confined to the female members of the tribe (being of blood-marking significance; the 'elder-women' are very prominent), and recalls the markings of animals, decoration or tangible symbolism is rare among the Seris. Not only are these people less advanced in æsthetic development than other American Indian tribes, but they are also 'at the bottom of the scale in the ratio of æsthetic to industrial motives' (p. 176).

A dearth of fishing tackle is also noted, but in the capture of the sea-turtle (a most prominent article of diet), the adaptation of means to ends is beautifully illustrated: 'The graceful and effective balsa is in large measure an appurtenance of the industry; the harpoon is hardly heavier and is much simpler than a trout-fishing tackle, yet serves for the certain capture of a 200-pound turtle; and the art of fishing for a quarry, so shy and elusive that Caucasians may spend weeks on the shores without seeing a specimen, is reduced to a perfection even transcending such artifacts as the light harpoon and fragile olla' (p. 189). The ingenious use of the young or crippled pelican, as an aid in the procurement of food may possibly have been borrowed from other California tribes. The arrow, the weapon of the chase, is, perhaps, even more notably perfected than the harpoon. Between the arrow and the harpoon, on the one hand, and the fire-drill on the other, there is a remarkable structural homology, the harpoon having been in all probability the primary device. With the Seris, the bow has now replaced the atlatl, or throwing stick formerly in use. In contrast with the arrow, the bow is a rude and clumsy device. The posture of the Seri archer is one of the most remarkable known. The development of the hunt has apparently 'blinded the Seri to the rudiments of agriculture,' and goes far to explain 'their intolerance of all animal associates, save the sly coyote that habitually hides its travail and suckling in the wilderness, and perhaps the deified pelican' (p. 203). The hunting of the horse is an acquisition of post-Columbian date, in which these Indians have developed rare skill.

As to food, the Seris are omnivorous, and their systematic scatophagy—the 'second harvest' of the tuna is carefully stored—gives them almost a bestial character, though in this peculiar practice the beginnings of a thrift sense and the germs of industrial economy are possibly to be seen. The 'houses' of the Seris are of the rudest sort, merely shelters adapted to the roving needs of the tribe, but it is very interesting to learn that 'placing and fitting of the beams and tie-sticks are accompanied by a chant, usually led by the eldest matron of the group,'—for women are the builders here. The chant is probably a very primitive 'worksong' of the sort Professor Bücher has recently discussed. The absence of the breech-clout (so common an article of primitive clothing) is, Dr. McGee thinks, accounted for by conditions of environment making 'the free-flowing and easily removable apron' of most service as a protective dress. An autochthonous dress of the Seris is the pelican-skin kilt, while as cords, fasteners, etc., fabrications of human hair are abundantly employed.

In so far as their peaceful industries are concerned, the Seris are among the most primitive of known tribes, and 'combine the features of the zoomimic and protolithic stages more completely than any other known folk, and in such wise as to reveal the relations between these stages and that next higher in the series with

unparalleled clearness' (p. 253). Their implements of stone reflect the conditions of their habitat remarkably well.

Seri warfares, like the hunting customs of the tribe, is 'largely sortilegic,' and the warfare of the tribe (devoid of military tactics in the strict sense of the term) is 'merely an intensified counterpart of their chase' (p. 261). To the 'blood-craze' of the hunters corresponds the 'war-frenzy' of the fighters. Poor in offensive and in defensive devices, the Seri Indians, apart from the natural conditions of their habitat, find their effective protection in 'their fleetness coupled with their habitual and constitutional timidity.' The famous 'poison arrows' of the Seris are discussed at pages 255–261, and a description given of the loathsome mess compounded by the medicine-man for tipping them.

The most interesting fact in Seri sociology is 'prominence of the females, especially the elderwomen, in the management of every-day affairs' (house building, transportation of family property, regulation of personal conduct, productive labor, shamanism, proprietary affairs, legislative and judicative functions, etc.). The social unit appears to be the maternal clan, with certain modifications and additions due to the general feeling of the tribe, the clan-mother being the central figure of the group, but the executive power residing in her brothers in the order of seniority. In other words, 'while the personal arrangement of the group is maternal, the appellate administration is fraternal' (p. 275). The contests for the chiefship are sometimes very protracted, but 'the choice really reflects physical force.' The process of adoption, so important generally with primitive peoples, seems 'entirely foreign to the thoughts of the tribe,' only a few sporadic and uncertain cases being on record. Since there is a surplus of women among the Seris, polygamy naturally prevails, although the practice is perhaps incidental and of comparatively recent origin. Of the sexual unions of these Indians the author remarks (p. 279): 'The primary mating of the Seri is attended by observances so elaborate as to show that marriage is one of the profoundest sacraments of the tribe, penetrating the innermost recesses of tribal thought, and interwoven with the essential fibers of tribal existence. Few, if any, other peoples devote such anxious care to their mating as do the Seri [the author compares them with the Australian aborigines]; and among no other known tribe or folk is the moral aspect of conjugal union so rigorously guarded by collective action and individual devotion.' The premarital tests are severe, and the conditions of the probationary period are such as to demand indubitable proof of control of sexual passion. Of the mortuary customs of the Seris, the most remarkable feature is 'the special dignification of females in respect to funerary rites,' something without exact parallel among other American aborigines. Traces of at least an inchoate belief in a future life, and of strong veneration for, or fear of, the spirits of the departed (matrons in particular), were noted, as indeed is indicated by certain funeral customs.

The Seri linguistic material was submitted to Mr. Hewitt, of the Bureau of American Ethnology, whose thorough-going comparative study (rather too decided, perhaps, in some respects) occupies pages 299–344. The result is to settle the status of Seri speech as an independent tongue, and not a Yuman dialect, as some have thought. Taken altogether, the Seri mind shows itself to be 'local, chance-dominated, exceeding lowly, and especially autochthonal in its contents and workings.' The author's views as to the meanings of the correlation of race-sense and stirpiculture are of great interest to all students of racial and individual development (p. 162): 'Even if the measure of the incarnation of ideals be reduced to the lowest maximum consistent with human knowledge it remains true that the progeny of successive generations are not the offspring of average parents, but of pairs at the perfection and conjugal culmination of their virile and muliebrile excellencies; so that the generations must run in courses of cumulatively increasing racial (or human) perfection, under a general *law of conjugal conation.*' Well, indeed, do the Seri Indians illustrate the incarnation of primitive ideals, as indeed the Greeks once did, and with not such moral descent as the latter sustained.

Another general fact concerning the Seris, of great importance to the psychologist, and

suggesting at once comparisons with childhood and the phenomena of genius, is the marked alternation of intense activity and complete repose—activity measured by hours, intervals of rest measured by days. Equally noteworthy is the rapidity of change from one state to the other. According to Dr. McGee, "the Seri are at once the swiftest and the laziest, the strongest and the most inert, the most warlike and the most docile of tribesmen; and their transitions from rôle to rôle are singularly capricious and sudden" (p. 156). This throws a new light upon the question of savage laziness and hints how unfair some of the earlier writers have been in picturing primitive man as uniformly inert. This essay is emphatically a valuable addition to the scientific literature about primitive man. The appearance of the author's companion study of the Papagos will be awaited with great interest.

ALEXANDER F. CHAMBERLAIN.
CLARK UNIVERSITY,
WORCESTER, MASS.

Verhandlungen der deutschen Zoologischen Gesellschaft auf der zehnten Jahresversammlung zu Graz, den 18 bis 20 April, 1900. Im Auftrage der Gesellschaft herausgegeben von Prof. Dr. J. W. Spengel, Schriftführer der Gesellschaft. Mit in den Text gedruckten Figuren. Leipzig, Verlag von Wilhelm Englemann. 1900. Pp. 170. Preis M. 6.

The most important matter brought before the tenth meeting of the German Zoological Society at Graz was the report of Professor Franz Ellhard Schultze, editor-in-chief of *Das Tierreich*. The year preceding the report witnessed the publication of several sections of this great work upon systematic zoology, the most notable being that of Labbé upon the 'Sporozoa' and that of Michaelson upon the 'Oligochæta.' That substantial progress will be made in the near future is seen in the fact that the following manuscripts were ready for the press: 'Hydrachnida' by Piersig, 'Halicarida' by Lohmann, 'Nemertina' by Bürger, the first division of the 'Amphipoda' by Stebbing, the 'Palpigrada' and 'Solifuga' by Kraepelin, the 'Libytheida' by Pagenstecher. The following sections are now in the process of editorial revision: calcareous sponges by Breitfuss, the second division of the 'Copepoda' by Giesbrecht and Schmeil, the second division of the 'Decapoda' by Ortmann, the first division of the 'Formicida' by Emery, the 'Pneumonopoma' by Kobelt, the 'Rodentia' by Trouessart, the 'Rhizopoda reticulosa' by Rhumbler, and the first division of the 'Apida' by Friese.

To insure prompt publication of the accumulating manuscript is a problem for whose solution the recommendation is made that a competent 'Superreviser, Secretar, and Bureauchef' be appointed to assist the editorial bureau in the laborious work of securing uniformity in matters of terminology, nomenclature and bibliography, and to maintain the unity of this monumental work which the German society has undertaken. Arrangements were consummated whereby in the future the *Tierreich* will be issued conjointly by the Society and the Royal Prussian Academy of Sciences, as will be shown by the title page of future issues.

The principal address of the session was given by Professor Karl Heider on 'Das Determinationsproblem,' a masterly review of the whole subject of experimental morphology. In a second paper Professor Heider calls attention to a new and strange genus of trematodes parasitic in the dolphin. This new type, *Braunina*, is peculiar in possessing a pedicel and a mantle developed to a degree hitherto unknown in the group, while suckers are entirely lacking.

Herr Künkel has investigated the capacity of *Limax* for the absorption of water which enters the body not only through the mouth, but also through the skin by absorption. The volume of the slug may be increased by this process as much as 209% while the specific gravity is correspondingly decreased and feeding activities are suspended until the water is reduced. The consumption of oxygen in respiration was studied and the rate of exhaustion of the air was found to be 0.36 ccm. per hour for each cubic centimeter of the slug's body. The respiratory process is carried on not only in the air-chamber, but also on the surface of the body.

Dr. Hans Rabl finds no evidence to support the ectodermal origin of the pigment cells in embryos of cephalopods. From their first

appearance the chromatophores are found *only* in the mesoderm. They are single cells with a single large nucleus, appearing to be multi-nuclear only when in degeneration they are invaded by adjacent connective-tissue cells. The author explains the expansion of the cells by the contraction of the radial fibers around it and its contraction by the elasticity of the cell membrane.

Other papers are by Herr Thon on 'The Copulatory Organs of the Hydrachnid Genus *Arrhenurus* Dugès'; by Dr. Doflein on 'The Inheritance of Cell Characteristics'; by Dr. Simroth on 'Self-Fertilization in Pulmonates'; by Dr. Escherich on 'The Germ Layers in the Muscidæ'; and a history and description of the Graz 'Zoologisch zoolomische Institut,' by Professor L. v. Graff.

The excursion of this session was made to the Austrian Zoological Station at Trieste founded twenty-five years before, largely through the efforts of Professor F. E. Schultze. Since the retirement, in 1896, of Professor Carl Claus, director of the station for many years, the control of the enterprise has been in the hands of a board representing the leading Austrian universities. With the change has come renewed activity, an enlarged building and increased equipment.

Charles A. Kofoid.
University of California.

A Select Bibliography of Chemistry 1492–1897. By Henry Carrington Bolton. Section VIII. — Academic Dissertations. City of Washington: published by the Smithsonian Institution. 1901. Pp. iv + 534.

This volume—number 1253 of the Smithsonian Miscellaneous Collections—is the third in Dr. Bolton's 'Bibliography of Chemistry.' It is devoted exclusively to those academic dissertations which have been printed independently, and especially to those from the universities of France, Germany, Russia and the United States. The number of the last is exceedingly small, for it seems not yet to be the custom of most American universities to require the printing of theses for the doctor's degree, although much of this work finds its way sooner or later into periodical literature. About seven thousand dissertations are catalogued in the volume, about four-fifths of the titles being German, and a large share of the remainder French.

The reviewer has been interested in tabulating the results of an examination of sample pages, scattered uniformly through the book. From this it appears that nearly five thousand of the dissertations are from German universities, slightly more than a thousand from French, and perhaps seven hundred and fifty from the Swiss, schools. Of the German universities, Erlangen, Berlin, Göttingen and Leipzig stand first, each furnishing about five hundred titles, while Freiburg and Heidelberg stand considerably lower, and are not very closely followed by Rostock, Tübingen, Jena and Würzburg. Of the Swiss universities, Zürich furnishes about as many titles as Rostock, and Berne as many as Jena. More than half the French dissertations are from l'École de pharmacie de Montpellier, most of the remainder being from Paris and from l'École de pharmacie de Paris, those from the latter being rather more in number than from the former. One hundred and thirteen titles are in Russian, and perhaps nearly as many more are from the University of Dorpat.

This glance reveals to us the position which Germany occupies in the teaching of chemistry, and, if the dissertations of the last few years alone were considered, it would be found that France stands much lower than is shown by the figures above.

Dr. Bolton will receive the thanks, especially of all chemists who are engaged in research, for this addition to his many valuable contributions to bibliography, for it affords access to a very important field of chemical literature, which, for want of an index, has hitherto been practically closed. The original dissertation is often of far more value to the investigator than the re-edited work which appears in the journals. The value of this book is still further increased by reference to those dissertations which are in the libraries of the Geological Survey and of the Smithsonian Institution; and also—this would certainly be missing in no book of Dr. Bolton's—by a very complete index, which fills ninety double-column pages.

While this volume completes the undertaking

begun by the author in 1888, of preparing a 'Select Bibliography of Chemistry,' he has now in preparation a fourth volume, which will afford him an opportunity of supplying omissions in the three already published.

JAS. LEWIS HOWE.

WASHINGTON AND LEE UNIVERSITY,
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Elementary Organic Analysis, The Determination of Carbon and Hydrogen. By FRANCIS GANO BENEDICT, PH.D., Instructor in Chemistry in Wesleyan University. Easton, Pa., The Chemical Publishing Co. 1900. 8vo. Pp. 86. Price $1.00.

The author states in his preface, "Perhaps no analytical operation is at once so fundamentally important and exasperatingly vexatious as the organic combustion. Notwithstanding this fact, save for the meager statements in one or two of the larger books on organic chemistry, no description of the process of the determination of carbon and hydrogen is accessible to most students. As a rule a knowledge of the operation is chiefly obtained by word of mouth.

"This little manual is presented in the hope that the descriptions of processes here recorded will aid in making this method of analysis more familiar and more satisfactory."

The author states that he has had an experience with over two thousand combustions and that in this book he has embodied such modifications of the general method as have been suggested by that experience.

Some idea of the book will be obtained from the following table of contents: Introduction, preparation of oxygen, compressed oxygen, gasometers or gas holders, air, purifying apparatus, rubber tubing and stoppers, combustion furnaces, combustion tubes, oxidizing agents, filling the combustion tube, boats, absorbing agents, absorbing apparatus, cleaning and weighing absorbing apparatus, weight of material used, burning out the combustion tube, general process of the combustion, combustion of nitrogenous substances, combustion of bodies containing the halogens, combustion of bodies containing sulphur, combustion of bodies containing the alkali metals, combustion of difficultly combustible bodies, combustion of liquids and volatile bodies, combustion of explosive bodies, calculation of results, appendix and index.

The book is well printed and of convenient size for laboratory use. For use in teaching students of chemistry the methods of combustion analysis it will be of great value, and even the experienced chemist will find in it many suggestions and new ideas.

W. R. ORNDORFF.

BOOKS RECEIVED.

Cyclopedia of American Horticulture. L. H. BAILEY, assisted by WILHELM MILLER. Vol. III., N-Q. New York and London, The Macmillan Company. 1901. Pp. xv + 1055–1486. $5.

School Geography, Europe and other Continents with Review of North America. RALPH S. TARR and FRANK M. MCMURRY. New York, The Macmillan Company. 1901. Third book. Pp. xx + 574.

The Limits of Evolution and other Essays illustrating the Metaphysical Theory of Personal Idealism. G. H. HOWISON. New York and London, The Macmillan Company. 1901. Pp. xxxv + 396. $1.60.

SCIENTIFIC JOURNALS AND ARTICLES.

The American Naturalist for April has as its first article a paper by B. Arthur Bensley, on 'A Theory of the Origin and Evolution of the Australian Marsupialia.' The adaptive modification of their teeth and feet are compared with those of placental mammals, the author concluding that the marsupials were differentiated from Didelphyd forms, but adding no evidence to show from what direction they entered Australia. R. M. Strong presents in detail 'A Quantitative Study of Variation in the Smaller North American Shrikes,' and Frank Russell describes 'A New Instrument for Measuring Torsion' in the long bones of the human skeleton, but applicable to other purposes. The valuable series of 'Synopses of North-American Invertebrates' is resumed, the present paper, the fourteenth of the series, by C. W. Hargitt, being devoted to 'The Hydromedusæ, Part I.' The number contains the quarterly record of gifts to institutions, and the appointments, retirements and deaths of scientific workers.

The Journal of Physical Chemistry, March, 1901, 'On the Dielectric Constants of Nitrils,' by Herman Schlundt. The fact that solutions

of salts in nitrils are good conductors of electricity makes a determination of the dielectric constant of importance. Hydrocyanic acid was found to have a higher dielectric constant than water. An increase in the size of the molecules of nitrils by the addition of carbon and hydrogen lowers the dielectric constant. 'The Fundamental Equation of a Multiple Point,' by Paul Saurel. 'On a Property of the Pressure-Volume Diagram,' by Paul Saurel. 'Dissociation Studies,' by Wilder D. Bancroft. A study of the equilibrium relations of the three modifications of ethyl-aldehyde.

THE April number (No. 2, Vol. XXIII.) of the *American Journal of Mathematics* contains the following memoirs: 'The Cross Ratio Group of 120 Quadratic Cremona Transformations of the Plane,' by H. E. Slaught; 'Memoir on the Algebra of Symbolic Logic,' by A. N. Whitehead; 'On a Special Form of Annular Surfaces,' by V. Snyder; 'On the Transitive Substitution Groups, whose Order is a Power of a Prime Number,' by G. A. Miller; 'Geometry on the Cubic Scroll of the Second Kind,' by F. C. Ferry.

THE leading article of the May number of *Popular Astronomy* is the concluding one of the series written by Herbert A. Howe, on 'Astronomical Books for the Use of Students.' G. Seneca Jones contributes a discussion of Professor Holden's recent article in *McClure's Magazine*, entitled 'What we Know about Mars'; George C. Comstock an article on 'Establishing a Meridian Line,' and Dr. J. Morrison the third instalment of a series on general perturbations and the perturbative function. 'The New Star in Perseus' is discussed by A. E. Douglass, of the Lowell Observatory, Flagstaff, Arizona, and by George E. Hale, of the Yerkes Observatory, and Professor J. G. Hagen's second chart and catalogue are printed. Observations are reported by David E. Hadden, F. E. Seagrave and Wm. E. Sperra. Dr. H. C. Wilson writes of the approaching total solar eclipse of May 17–18, 1901, accompanying his article by charts showing the path of the eclipse and its track across Sumatra and Borneo. The General Department contains notes upon Amherst College Total Eclipse Expedition, the Benjamin Apthorp Gould fund, Eros a Double Planet, Astronomy in High Schools, List of Stellar Novæ and So-called New Stars-Book, reviews of Serviss, 'Pleasures of the Telescope,' and Comstock's 'Text-Book of Astronomy,' 'Astronomy in the 20th Century' and the Alvan Clark and Sons Corporation. The usual planet and asteroid notes are also included.

SOCIETIES AND ACADEMIES.

ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

AT the 317th meeting, held on April 9th, Mr. George C. Maynard exhibited an interesting series of early time-keeping apparatus, consisting of a set of four sand glasses, mounted in a frame, used during the fourteenth century in churches; a water clock; a pewter and glass time lamp; a time candle, and a small cocoanut cup from Lower Siam, having a perforation; the cup, when floated on a basin of water, sinks in a stated period.

Hon. Edward F. McSweeny, Assistant Commissioner of Immigration, port of New York, read a paper on the immigration question. The paper was accompanied by charts and photographs of racial types. Mr. McSweeny, in discussing the subject of immigration, gave some historical account of the origin and cause of such movements, and, in reference to the tide that early set toward this country, he called attention to the variety of peoples that were represented. In the chart showing immigration by years, the diminution of the influx of foreigners during the periods of industrial depression was most marked. Mr. McSweeny pointed out that the foci of immigration have shifted from northern Europe to eastern Europe, and that the bulk of immigrants are Italian, Slavic and Oriental, of an undesirable class. He fears that the present tendency to concentration in all fields of industrial endeavor may be utilized in connection with the introduction of vast hordes of these aliens to break down labor conditions and wage standards, and suggests that legislation to exclude this undesirable class should be framed. The paper was discussed by Major J. W. Powell, John R. Proctor, and a number of others present.

WALTER HOUGH.

PHILOSOPHICAL SOCIETY OF WASHINGTON.

THE 535th regular meeting was held April 27th, President Walcott in the chair.

Mr. I. M. Cassanowicz, of the National Museum, presented an interesting paper on 'The Funerary Rites of the Ancient Egyptians.' He said the monuments and remains of ancient Egypt are chiefly of a sepulchral character. The Egyptians believed in a personal existence after death. Their conception of the conditions and localities of the future existence was vague, but these seem to have been patterned after the conditions known in Egypt: the dead formed a nation who worked for Osiris as for a Pharaoh. As the Egyptians could not conceive of existence apart from a tangible substance, a link was needed to connect the *Ka*, the representative of personality, with the world of substantial things; this link was the body, and so its preservation was indispensable.

The various modes of embalming were then described, all involving a process of steeping in natron for 70 days. The bodies of the poor were preserved by soaking in salt and hot bitumen, whence the name 'mummy.' Then followed a minute description of an Egyptian funeral, largely derived fiom the Papyrus of Ani, a finely illustrated 'Book of the Dead' a facsimile of which is in the National Museum.

The next paper was by Mr. A. L. Baldwin, of the Coast and Geodetic Survey, on 'The Measurement of Nine Primary Bases in 1900.' The bases referred to are those required to control the triangulation which is now being carried both northward and southward from the great transcontinental belt of triangulation in latitude 39°, and will eventually give an arc of the ninety-eighth meridian twenty-three degrees long in the United States. On this triangulation it was decided to measure the bases with considerable rapidity while keeping the accuracy fully up to the requirements of the triangulation. Five sets of base apparatus, namely, the Eimbeck duplex bars and four tapes, were used on each base, about one-fifth of the measurement being made with each. Each set of apparatus was standardized under the field conditions at the first and last base, using the iced bar formerly employed on the Holton Base as the standard. The paper was a statement of the methods of measurements and of some of the results obtained in the field, and closed with a good series of twenty-six lantern slides showing the different forms of apparatus in actual use in the field. The greatest difference between measures of the same base was 20 mm. to the kilometer. The nine bases were measured by a party of ten officers and men in but little more than six months.

CHARLES K. WEAD,
Secretary.

BIOLOGICAL SOCIETY OF WASHINGTON.

THE 339th meeting was held on Saturday evening, April 20th. Mr. O. F. Cook read a paper on 'The Shading of Coffee,' in which he advanced the belief that there is no basis in reason or observed fact for the common idea that shade is a general necessity for the coffee plant. It was shown that the beneficial effects connected with shade arise only from the protection afforded against drought, erosion and winds, and that in regions not affected by injurious climatic extremes the planting of shade trees is justified from the cultural standpoint only by the increased fertility imparted to the soil by means of the nitrogen-fixing root tubercles of leguminous species. This being the case, it was thought that leguminous fertilizing might be effected by shrubs and herbs yielding edible or otherwise useful fruits and requiring no more space or care than those yielding no direct returns.

Mr. Charles L. Pollard presented a paper entitled 'Some Strange Methods of Plant Naming,' giving a brief review of the various classes of incorrect generic and specific names, and commenting on the practices that have been followed in each case. He discussed particularly the so-called barbaric names of Adanson and Necker; those falsely constructed from classical sources, and those whose meanings are at variance with actual facts. The speaker also discussed the modern tendency to carelessness in the publication of scientific names, and recommended that botanists give united support to some movement in favor of greater exactness in nomenclature.

Dr. Theodore Gill made some remarks 'On the Mode of Progression and Habits of some

Dinosaurs,' contending that the supposed saltatorial habits of forms like *Hadrosaurus* and *Iguanodon* were physical impossibilities. Besides noting that the force of gravity would prevent so much action in such ponderous animals, the speaker also mentioned structural characters incompatible with it—notably the absence of the calcaneum.

Wilfred H. Osgood,
Secretary.

TORREY BOTANICAL CLUB.

At the meeting of the Club on February 27, 1901, the scientific program was introduced by Dr. Britton with a paper 'On some *Senecios* of the Eastern United States.' The critical study of this genus dates from 1893, when Dr. Rusby collected in the Green Mountains a peculiar plant, described but not published in the middle of the century by Oakes and named by him *Senecio Robbinsii*. Dr. Rusby described this plant in the *Bulletin* in 1893.

While working up the genus for the Illustrated Flora 1895–6, Professor Britton found that *Senecio aureus* of Gray's Manual included the six following species: *Senecio obovatus, S. discoideus, S. Balsomitae, S. Smallii, S. compactus, S. Robbinsii;* besides *S. aureus* with two varieties. Professor Britton showed specimens of the species discussed: 1st, *S. aureus*, common and known by its large cordate basal leaves, growing in wet meadows; 2d, var. *gracilis*, with smaller cordate leaves, considered by Professor Greene a distinct species. Professor Britton had on one occasion observed intermediate forms and thought the distinction not clearly established. Both forms are growing in the Composite beds in the Garden. 3d, var. *pauciflorus*, smaller in every way than *S. aureus*, found in Newfoundland and Labrador; 4th, *S. Robbinsii*, smooth, with thin and jagged leaves, belonging to New England and the Adirondacks; 5th, *S. Smallii*, with long basal leaves and large corymbs of small heads. This occurs in the south, and is reported as far north as Pennsylvania. 6th, *S. obovatus*, with obovate leaves, including two subspecies, the first *elongatus* from the Delaware valley, with the lower portion of the leaves elongated, and smaller heads almost devoid of rays; the second, *rotundus*, from Tennessee and Missouri, which may be a distinct species. *S. discoideus* and *S. compactus*, are western species, separated by Dr. Rydberg.

Professor Britton quoted from a recently published study of *Senecio* by Professor Greenman, who distinguishes two additional varieties of *S. balsamitæ, pauperculus* and *prælongus*. Professor Britton said that there was much need of further material and observations in the field of all these forms.

Specimens of the *tomentosa* group of *Senecio* were then shown: *S. tomentosus* of Michaux, common along the Atlantic seaboard as far north as New Jersey; *S. antennarifolius*, found by Dr. Allen and Professor Britton at the White Sulphur Springs in West Virginia. This species is established in the Garden and flowers early.

A peculiar and undescribed species was exhibited collected by Professor Earle in Henry County, Alabama, resembling the *tomentosa* group in general characters, but having no tomentum. This differs from all other species in having the teeth tipped with round glands.

Dr. Britton expressed the hope that field notes on this genus would be made during the coming season.

The second paper, also by Dr. Britton, was on *Eupatorium*, and illustrated the three Linnæan species, *E. purpureum, E. maculatum*, and *E. trifoliatum*; the first two were collected at Copake Iron Works last summer on a field excursion of the Club. Of these, *E. purpureum*, with thin almost glabrous leaves with sharp teeth, grows in woodland and copses; and *E. maculatum* has leaves thick and rugose, with prominent veins broader and more ovate, and not as sharply serrate as the last; stem rough and spotted; grows in open meadows.

E. trifoliatum has been found in the South, as far north as Pennsylvania; it was named by Elliott *E. ternatum.*

The essential distinction of this species is the crenate leaves; the stem is smooth, the leaves narrower and inflorescence often larger than *E. purpureum.*

Dr. MacDougal showed an opened spathe of skunk cabbage found in the Garden, which was greeted as the first authentic sign of spring.

He exhibited an experiment on the force exerted in the swelling of seeds; a strong iron pipe was filled with peas and water, and a test tube inserted in the top. In 24 hours from the time the peas were put in, a pressure was registered of eight atmospheres, or 120 pounds to the square inch, the highest pressure hitherto recorded by this means.

Dr. MacDougal also discussed malformations in *Arisaema*, and showed specimens of *A. triphyllum* with the spathe double or forked, with the spadix divided and flattened or proliferous, and with two leaves from the same petiole. Also *A. dracontium* with the tapering end of the spathe divided into double hood-like forms. He called attention to the fact that early specimens may be infested with a fungous growth which causes the hood to stand erect.

EDWARD S. BURGESS,
Secretary.

DISCUSSION AND CORRESPONDENCE.

THE KEELER MEMORIAL.

PROFESSOR KEELER'S sad and sudden death last August came as a great and unexpected shock to his many friends and admirers. Of his work and life it is unnecessary to speak here; it has been sympathetically and ably described by Campbell, by Hale, by Brashear, by Perrine and others. The whole scientific world has united to mourn his loss, both as a colleague and as a friend. But nowhere has his death been more keenly felt than among his many friends and associates whom he formed while connected with the Allegheny Observatory. It was here that he began his scientific career as assistant to Professor Langley, and it was here, as Langley's successor, that he subsequently accomplished much of the work that has rendered his name famous.

It seems therefore particularly fitting that the new Allegheny Observatory, the first plans for which were drawn by Keeler, should contain a memorial to his memory. When the news of his death was received we arranged to have his name placed on the frieze of the new building among the names of other great American astronomers of the past. But some more special tribute is needed to mark our appreciation of his high attainments as a scholar, of his distinguished services not only to our own observatory, but to the whole scientific world, and last but by no means least to his noble character as a man.

Keeler's last great work, the work upon which he was still engaged when death so suddenly cut him down in the prime of life, was being carried on with the Crossley reflecting telescope, an instrument which for the first time under his able management was being made to demonstrate its possibilities. It is proposed, therefore, to erect the 30-inch reflecting telescope of the new Allegheny Observatory as a peculiarly fitting memorial to his memory; one which he himself would prefer to any monument or statue. The suggestion has met with much favor among his many friends, and a fund is now being raised to carry it into effect.

We desire to make this memorial a general rather than a local tribute to Professor Keeler. A number of voluntary subscriptions have already been promised, and many of his scientific friends and colleagues from other institutions have expressed a desire to contribute. We feel sure that there are many others that only await an opportunity or an invitation to join the movement, and I have therefore written this notice to bring the subject to their attention. Those who wish to subscribe to the fund will kindly send their names and the amount of their subscription to Mr. John A. Brashear, chairman of the Observatory committee, or to the writer. All contributions will be acknowledged from time to time in SCIENCE. If the fund raised exceeds in amount the estimated cost of the memorial telescope, which is $10,000,* the balance will be used either to found a general fellowship for the study of astrophysics, 'the Keeler Fellowship,' or for the award of a 'Keeler Medal' for work in the same field, as the majority of the contributors may decide; the award in either case to be made by the Astronomical and Astrophysical Society of America or some other scientific body equally representative of general interests.

We hope all scientific men will join us in this effort to do honor to the name of one who did so much for the advancement of knowledge in

* It is expected that at least this amount will be subscribed here in Pittsburg and Allegheny alone.

his chosen field of work, who was so broadly sympathetic in his views, and who endeared himself to so many by his personal character and attainments.

F. L. O. Wadsworth.

Allegheny Observatory,
May 1, 1901.

THE LARYNX AS AN INSTRUMENT OF MUSIC.

I see in the last number (April) of the *American Journal of Science* an excellent paper by Professor Scripture on the 'Nature of Vowels.' After a graphic analysis of these sounds, he criticizes with much acuteness the views of other writers. Of this I have nothing to say, except that I have been greatly interested. But in the last paragraph he concludes that the so-called vocal cords cannot vibrate in the manner of strings nor of tongues of reed-pipes, but must vibrate *compressively* in the manner of *elastic cushions*.

Now I write this to say that somewhat similar views have been expressed by me in my class lectures on comparative physiology for 25 years, although not published until last year in my book on 'Comparative Physiology and Morphology of Animals.'

On p. 210 of that work, speaking of the *larynx as a musical instrument*, after showing that it cannot be likened to a stringed instrument nor to a reed-pipe, I say: "It is strange that no one has thought to liken it to an ordinary *horn*—a stage horn, or better, a *French-horn*. In this instrument the sound is modulated exactly as in the larynx, viz., by the *tension* and the *pressing together* of the *lips of the performer*. The edges of the *rima glottidis* ought to be called *the vocal lips*—as indeed they are, and not *the vocal cords*—which they are not in any sense. The analogy between the two instruments is perfect. The performer on the horn presses his lips together tighter, makes them tenser and the opening between them smaller, in proportion as he desires a higher note. He then drives the air between the tense lips so as to set their edges in vibration. This vibration, by alternate partial closing and opening of the aperture, gives rise to *successive jets or pulses of the out driven air*, and this in its turn gives corresponding pulses to the air in the sounding cavity of the horn. Precisely the same, as we have seen, takes place in the larynx. The only wonder is that so small an instrument as the larynx and the mouth-cavity should be capable of such marvelous effects."

It is true I do not say anything about '*compressive vibrations*,' but I think there can be no doubt that the nature of the vibrations in the two cases is identical.'

Joseph Le Conte.

Berkeley Cal., April 24, 1901.

THE PHOTOGRAPHY OF FOSSILS.

To the Editor of Science: In the current issue of Science (May 3, 1901), p. 710, report is given of a paper read before the New York Academy of Science by Mr. Gilbert van Ingen, on 'A method of facilitating Photography of Fossils.'

It may be of interest to your readers to know that a patent covering the process there described was issued in December 1899, and a company, the 'Scientific Photograph Company,' under the business management of Roger H. Williams (Address 28 East 28th St., New York) has been formed to execute orders for the preparation of illustrations by this patented process. The results obtained are successful in reproducing the most delicate details of the form of opaque objects of all kinds in which accuracy is demanded. The process eliminates both the interpretation of the artist and the distorting effects of color and uneven reflection of natural surfaces, and is proving of great value as a means of reproducing, in publications, the exact form of fossils and other objects.

Henry S. Williams.

Yale University,
May 7, 1901.

SHORTER ARTICLES.

VARIATION IN LIGHT OF EROS.

The range of variation in the light of Eros, which has been diminishing during the spring, has now become zero. In February, 1901, it was found by European astronomers to amount to 2.0 magn. Observations by Professor O. C. Wendell, with the Harvard Equatorial, showed that the range on March 12, 1901, was 1.13

magn.; on April 12 it was 0.40 magn., and on May 6 and 7 it was imperceptible and apparently less than 0.1 magn.

EDWARD C. PICKERING.

HARVARD COLLEGE OBSERVATORY, May 8.

A SIMPLE OSMOMETER.

THE end of a thistle tube is drawn out, broken off and closed temporarily with wax. The bulb is then filled with molasses and a piece of pig's bladder,* is securely but loosely tied over the

mouth. The wax is removed from the end of the stem and the end well fused. Two thicknesses of strong linen are tightly drawn and securely tied over the membrane to take the strain. The bulb is then placed in water, when in a few minutes the column of liquid becomes higher and the air column compressed by the osmotic action through the membrane.

In two or three days the maximum pressure is obtained, then the length of the air column is taken. The air in the stem is allowed to expand to its normal condition by puncturing the membrane with a needle and the length of the air column measured; which length, divided by the length under compression, gives the pressure in atmospheres.

The greatest pressure I have yet obtained with an apparatus of this sort is the expansion of 1.5 cm. to 13.2 cm., showing a pressure of 8.8 atmospheres, or 668.8 cm. of mercury, or 129 pounds per square inch.

The highest pressure I find recorded for Pfeffer's cell is 436.8 cm. mercury.*

The air column after expanding will not be so long by six to eight per cent. as it was before compression, showing that some of the air has been absorbed by the liquid.

The accompanying figure will serve to show how the apparatus is arranged.

E. E. BOGUE.

LABORATORY OF PHYSIOLOGICAL BOTANY, HARVARD UNIVERSITY, April 16, 1901.

* These bladders may be obtained of Kny-Scheerer Co., 19th street and 4th Avenue, New York City. They are clean and dry like parchment, and cost ten cents each or one dollar per dozen.

* Goodale's 'Physiological Botany,' Vol. II., p. 229.

CURRENT NOTES ON PHYSIOGRAPHY.

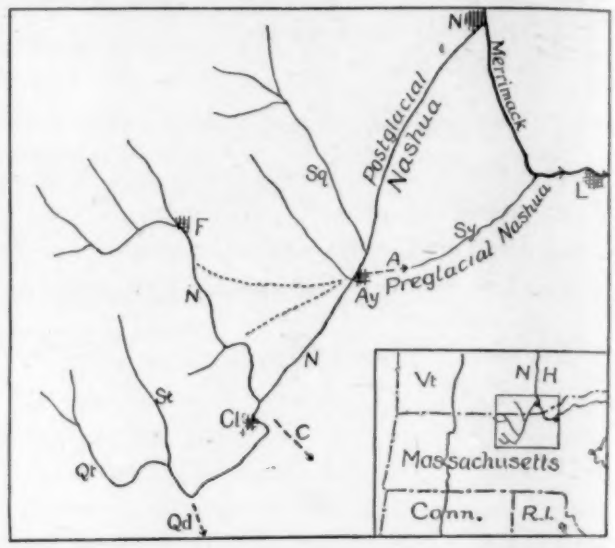
PHYSICAL GEOGRAPHY OF THE TEXAS REGION.

THE third folio of the Topographic Atlas of the United States is entitled 'Physical Geography of the Texas Region' by Hill. It may well serve as a type of many to follow. Twelve folio pages are given to text, chiefly concerned with an explanation of relief and drainage; then follow a sheet of nine climatic and other diagrams, four sheets holding 22 photographic views of typical landscapes, five sheets presenting 24 small topographic maps of typical reliefs and streams, and finally a folded map of Texas drawn under Hill's direction by Selden and Johnson on a scale of 25 miles to an inch with contours every 250 feet. The imperial area of the 'Texas region' is indicated by the statement that each of more than twenty physiographic subdivisions has an extent equal to that of an average State. Mountains, plateaus and plains, canyons, valleys and waste-floored basins (bolsones) are described in so great variety that selection for special remark is difficult. Descriptions are marked by a thorough-going adoption of explanatory methods, such as have always found ardent ad-

vocacy in Hill's writings. Terminology is largely flavored with words of Spanish origin, taken from the language that was once general and that is still familiar towards the Rio Grande. Plains are classified as constructional and destructional; the first being the result of accumulation, the second of denudation. Constructional plains are either sea-made or land-made; the latter including many examples of surfaces covered by the coarse or fine wash from higher ground. The destructional plains here found are usually 'stratum plains,' that is, surfaces of hard strata from which weaker overlying strata have been stripped; and of these three sub-classes are given, mesa plains, dip plains, and cut (or dissected) plains. Paleoplains is suggested as a name for buried destructional plains, but the word is objectionable etymologically; ancient plain may serve instead, as all the other classes of plains are indicated by adjectives. The descriptions of the Texan rivers show clearly enough that the conventional idea of a river as a constant current of water needs many modifications to fit it to regions of moderate rainfall and plentiful rock waste.

THE NASHUA VALLEY, MASS.

THE 'Geological History of the Nashua Valley during the Tertiary and Quaternary periods' is discussed by Crosby (*Technology Quarterly*, Boston, XII., 1899, 288–324, 2 maps, 2 pl.). The lower lands of eastern Massachusetts are regarded as parts of a Tertiary peneplain, eroded beneath the uplifted Cretaceous peneplain of the central and western uplands of Massachusetts; the remnants of the latter form hills on the former. Previous to the Tertiary erosion, a coastal plain of Cretaceous sediments is supposed to have overlapped the southeastern part of the older peneplain and through this cover a number of east or southeast-flowing rivers were superposed on the greatly deformed and denuded underlying rocks. Traces of this system of drainage are found in the headwaters of certain rivers whose valleys now converge in a general southeasterly direction towards notches in the hills through which their united volume is thought to have once continued in about the same course, but from which it seems to have been in several cases diverted by headwater capture by small streams that grew along a belt of weak slates. The upper Nashua river is the best example of this kind, a number of its head-



Rough Diagram of Nashua River System, Mass. Cities: Ay., Ayer; Cl., Clinton; F., Fitchburg; L., Lowell; N., Nashua. Streams: N. N., Upper Nashua; Qt., Quinepoxet; Sq., Squannacook; St., Stillwater, Sy., Stony. Tertiary Water Gaps: A., Ayer; C., Clinton; Qd., Quinsigamond.

water branches having been gathered from other systems into a single trunk. During the progress of these captures and adjustments, broad, low-grade valleys were opened, their sub confluent floors constituting the Tertiary peneplain, above mentioned. A number of narrow gorges in these valley floors, now concealed by drift and discovered by borings in connection with the extensive works of the (Boston) Metropolitan Water Board, are explained as the result of a preglacial elevation; and as such they may come to be compared with the narrow young valleys so distinctly seen in the uplifted Tertiary peneplain of Pennsylvania, but not hitherto identified in central New England. During the retreat of the ice sheet, lakes were formed in front of it in the upper Nashua valley; their outlets were across notches among the hills, at whose level a number of deltas and sandplains are now found. Drift obstructions in the broad notch traversed by the preglacial Nashua trunk seem to have diverted its flow northeastward along its present lower course into the Merrimack.

It is to be hoped that fuller details, especially in

the form of maps, may in due time be presented regarding the glacial lakes above noted. As to the restoration and development of the Tertiary drainage systems, the problem is inherently difficult on account of the unproved inland extension of the Cretaceous coastal plain, of the complicated rock structure of the region, of the uncertain relation between river volume and valley size in the advanced stage reached by the Tertiary cycle of erosion before the glacial period, and of the large volume and irregular distribution of the drift. Additional examples of streams, explainable by the same theoretical process, would perhaps lead as far towards demonstration as the case allows.

W. M. DAVIS.

CURRENT NOTES ON METEOROLOGY.

MONTHLY WEATHER REVIEW.

THE *Monthly Weather Review* becomes more and more indispensable to teachers and students of meteorology with every succeeding number. Under the able editorship of Professor Cleveland Abbe, the *Review* is rapidly enlarging its scope and its sphere of usefulness. The number for December (issued in February) contains, among its special contributions, 'The Circulatory Movements of the Atmosphere,' a translation of portions of a paper by Professor V. Bjerknes, recently published in the *Meteorologische Zeitschrift*, and 'Line Integrals in the Atmosphere,' by Professor F. H. Bigelow. In the 'Notes by the Editor,' Professor Abbe takes up a great variety of topics. In 'Micro-Photographs of Snow Crystals,' the history of the study of snow crystals is briefly reviewed. Under 'Bombarding the Hail Clouds' the question as to the possibility of dispersing hail storms by means of cannonading is answered by Professor Abbe as follows: "The Editor would state that although statistics show that during the past year 15,000 shooting stations were established in Italy, and a very large number in southern France and Austria, yet there is no evidence whatever that the shooting done by these stations has had any effect whatever upon the hailstorms or the hail." A short paper on 'Oscillations of the Lakes and the Climate in Arid Regions' mentions the decreasing depth of Great Salt Lake, the notable diminution of the quantity of water in the streams and wells of Turkestan and Bokhara, and the shrinking of Lake Ngami, in South Africa, and points out that these observations do not indicate a permanent change in the conditions of the atmosphere, these lakes having gone through many similar dry periods before now. Other papers are 'The Commercial Importance of Storm and Weather Forecasts,' 'The Evolution of the Thermometer' (a review of Dr. H. C. Bolton's recent book); 'Correlation of Weather in Distant Localities,' and 'Lightning from Cloudless Skies.' A recent investigation of the 'Relations between Summer and Winter Temperatures,' by Dr. O. L. Fassig, of Baltimore, is found to show that neither warm nor cold summers have any more relation to the succeeding winter temperatures than have the normal summers, or, in general, that there is no regular alternation or period in atmospheric temperatures.

NEW CHARTS OF MEAN MONTHLY RAINFALL.

THE first charts showing the mean monthly rainfall for the world were constructed by Dr. A. J. Herbertson, and published in Bartholomew's new 'Atlas of Meteorology' (1891). Several charts of mean annual rainfall had previously been published, the first fairly complete one being that of Loomis (*Am. Journ. Sci.*, third series, Jan., 1882; revised edition, *Ibid.*, Jan., 1883). Seasonal rainfall charts have recently been constructed by Supan. Herbertson's monthly rainfall charts have now appeared in 'The Distribution of Rainfall over the Land' (*Roy. Geogr. Soc.*, London, 1901, 8vo, pp. 70), on a considerably larger scale than that adopted for them in the 'Atlas of Meteorology.' The discussion is also much more extended than in the 'Atlas.' This monograph will naturally not attract as much attention as it would have done had not the charts already appeared, but nevertheless it may be said that Herbertson's 'Distribution of Rainfall over the Land' is one of the most important meteorological publications of recent years.

NOTES.

ARCTOWSKI, the meteorologist of the *Belgica* expedition, contributes to *Ciel et Terre*

for March 16th a paper entitled 'A propos de la question du climat des temps glaciaires,' in which he states it as his belief that the problem of the climate of glacial periods will be solved through a careful study of the meteorological and other conditions of the Antarctic.

Mr. H. N. Dickson, lecturer in physical geography in the University of Oxford, contributes a paper on 'The Circulation of the Surface Waters of the North Atlantic Ocean' to the *Philosophical Transactions of the Royal Society of London*, Series A, Vol. 196, pp. 61–203. The plates, which are colored, show the monthly distribution of temperature and of salinity in the surface waters of the North Atlantic during the years 1896 and 1897.

'Cloud observations during 1896 and 1897 at Toronto' is the title of a recent publication of the Meteorological Service of the Dominion of Canada (4to, Toronto, 1901, pp. 27). These observations were begun September 21, 1896, and were made by means of theodolites. The full tables of observations are given, but there is no discussion of the results, there being only the briefest summary of average altitudes and velocities by months.

Mammoth Tank, in the eastern portion of San Diego Co., Cal., on the line of the Southern Pacific R. R., is one of the most interesting meteorological stations in the United States. 'The Climatology of Mammoth Tank' is the title of a brief article in the February number of *Climate and Crops: California Section*. The mean annual rainfall for 23 years is 1.81 inches. The maximum temperature recorded was 130°, on Aug. 17, 1878. The warmest month is July, with a mean temperature of 98.5°.

R. Dec. Ward.

FRANÇOIS QUESNAY.

The Smithsonian Institution has received a Livre d 'Or, published in commemoration of M. François Quesnay, who died in December, 1774, at the age of eighty years, and was buried at his birthplace, Méré, Seine-et-Oise, France.

The monument and book were the project of the Société populaire, of which M. J. Allain-Le Canu was president and prime mover. The monument was determined upon at Méré during the Fête Scolaire held July 10, 1892, and was completed and inaugurated August 23, 1896. At both ceremonies there were large attendance and great enthusiasm. At the former, addresses were delivered by M. Quesnay de Beaurepaire, the great-grandson of him whom they honored, and at the latter by MM. Bourgeat, representing the Minister of Public Instruction and Beaux Arts, Frederick Passy, M. Bellan and M. Marcel Habert.

M. François Quesnay was an ignorant country boy. He did not learn to read until after he was eleven years old, when he became enamored of the science of medicine, in which he acquired such skill as that he was appointed physician to the King, Louis XV. He became the founder of the science of political economy in France, and finally one of the most learned men of his country and his age. His eminence in these branches of science was such that, two hundred years after he was born, his friends and the neighbors of his town, desiring to give him honor according to his renown, erected a monument in his memory in the town of his birth.

Alexander Quesnay, descendant of François, came to America and fought on her side during the War, of Independence. He remained here after the war, taking up his residence in Richmond, Va., where he was chosen and served as president of the Academy.

Thomas Wilson.

A SUMMARY OF WISCONSIN ARCHEOLOGY.

Members of the Wisconsin Society of Natural History are making systematic efforts to summarize the data of Wisconsin archeology and to preserve the archeological records, specimens and mounds of the State. A committee has been appointed for this purpose. It consists of C. D. Stanhope, H. Denison, W. J. Bennetts and Charles E. Brown. This committee has prepared a circular letter to be sent to every person in the State who is thought to be interested in the archeology of Wisconsin.

There are about three hundred collections of specimens from Wisconsin, varying in size from five hundred to five thousand objects, which

are known to be in different parts of the State. There are no headquarters for these collections, or for a typical series from them, nor is there any record covering the entire range of forms or number of geographical areas. Many specimens pass to foreign countries without a record or photographs being taken for the State. It is not the desire of the Wisconsin people to prevent the study of the antiquities of the State by outsiders or even their acquirement of specimens, but rather to secure records, drawings and other data for a central State collection to be available for study by all. Eventually State appropriations for a survey of the mounds are to be sought.

The Wisconsin Society of Natural History was founded by Increase Lapham and others, who began archeological work on a firm basis. It now proposes to establish a new grade of membership in the archeological section, for people living at a distance from Milwaukee. The regular membership fee is three dollars per year. The fee for the new grade will be one dollar. A meeting will be held at the Milwaukee Public Museum in May, to which all known students and collectors of Wisconsin archeology residing in the State will be invited. The object of this meeting will be to discuss ways and means for the study and preservation of Wisconsin antiquities.

It is hoped that students and collectors will be brought into closer relationship by the publication of a bulletin, which, it is expected, will be established as a result of this meeting. The foundation of an anthropological reference library, the lack of which is keenly felt, and a central place of record, where reports of explorations may be heard and discussed, is also expected by the committee as an outcome of the meeting.

The people interested in this movement may do lasting good by striving to preserve the prehistoric mounds by enclosing them in parks, by a close cooperation with the State University, by a broadening of the proposed archeological research into that of general ethnology, and, finally, by the foundation of a permanent department of anthropology in the University.

HARLAN I. SMITH.

SCIENTIFIC NOTES AND NEWS.

AT the annual meeting of the American Academy of Arts and Sciences, held on May 8th, it was unanimously voted to award the Rumford Medal to Professor Elihu Thomson 'for his inventions in electric welding and lighting.' The Academy has granted to Professor Theodore W. Richards, of Harvard University, the sum of $500 from the income of the Rumford Fund, in aid of a research upon the Thomson Joule effect.

PROFESSOR J. H. VAN'T HOFF, of the University of Berlin, will give a limited number of lectures on physical chemistry at the Kent Chemical Laboratory of the University of Chicago, beginning on June 19, 1901.

M. BERTHELOT, the eminent chemist, ex-Minister for Foreign Affairs, and permanent secretary of the Paris Academy of Sciences, who has been elected a member of the French Academy in succession to M. Bertrand, the mathematician, was officially welcomed to the Academy by Mr. Lemaître on May 2d.

M. ZEILLER has been elected a member of the botanical section of the Paris Academy of Sciences in the place of the late Adolphe Chatin. M. Zeiller received twenty-five votes, while twenty-two were cast for M. Renault. MM. Bureau Costantin and Mangin were also candidates.

THE following fifteen candidates have been recommended by the Council of the Royal Society for election to membership: Professor Alfred William Alcock, M.B., Mr. Frank Watson Dyson, M.A., Mr. Arthur John Evans, M.A., Professor John Walter Gregory, D.Sc., Captain Henry Bradwardine Jackson, R.N., Mr. Hector Munro Macdonald, M.A., Mr. James Mansergh, M.Inst.C.E., Professor Charles James Martin, M.B., Major Roland Ross, M.R.C.S., Professor William Schlich, Ph.D., C.I.E., Professor Arthur Smithells, B.Sc., Mr. Michael Rodgers Oldfield Thomas, F.Z.S., Mr. William Watson, B.Sc., Mr. William Cecil Dampier Whetham, M.A. and Mr. Arthur Smith Woodward, F.G.S.

AT the annual meeting of the American Academy of Arts and Sciences, held May 8th, the following elections took place: *Associate*

Fellows, T. C. Chamberlin, of Chicago, and John Fritz, of Bethlehem Pa.; *Foreign Honorary Fellows*, A. Celli, of Rome; A. Engler, of Berlin; F. von Richthofen, of Berlin, and G. Paris, of Paris.

AT a meeting held at Cambridge University on April 27th to make some acknowledgment of Professor G. D. Liveing's services to science it was resolved:

That as a mark of our personal regard for Professor Liveing and in recognition of his valuable services to science and to the University, town and county, a testimonial be presented to him, and that it consist of a portrait of him to be painted by an artist selected by a committee in conjunction with Professor Liveing; the destination of the portrait to be determined by the subscribers.

AT a meeting of the New York Academy of Sciences held on May 6th, Professor Franz von Leydig, of Würzburg, was elected an honorary member of the Academy. The Academy adopted also the following resolution, to be presented to Professor Leydig on the occasion of his eightieth birthday, on May 21st: "The New York Academy of Sciences extends to Professor Franz von Leydig many hearty congratulations on the occasion of his eightieth birthday. In offering to Professor Leydig an election to honorary membership, the members of this Academy desire to express their appreciation of his long-continued services to science, and of the profound and lasting influence that his memorable researches have exerted on the progress of zoology. With all best wishes they send him a cordial greeting from America."

MR. CHARLES HAWKSLEY has been elected President of the Institute of Civil Engineers, London. The council has made the following awards for papers read and discussed before the institution during the past session: A George Stephenson medal and a Telford premium to Mr. Harry E. Jones; Telford medals and premiums to Mr. G. A. Hobson and Mr. E. Wragge; a Watt medal and a Telford premium to Mr. Joseph Husband; Telford premiums to Mr. J. T. Ford, Mr. L. L. Buck, Mr. W. H. Stanger, Mr. B. Blount and Mr. W. J. Doak; Crampton prize to Mr. E. Sandeman.

KING EDWARD VII. has consented to become patron of the Royal Geographical Society and to continue the royal premium of two previous reigns for the promotion of geographical research, which takes the form of the two royal medals awarded annually. The Society itself has resolved to found a Victoria medal, to be awarded occasionally for research in scientific geography.

DR. REINHARD SÜRING has been appointed chief of division, and Dr. Johannes Edler aid, in the Meteorological Institute at Berlin.

DR. WILLIAM COLLINGSBRIDGE has been appointed medical officer of health for the City of London.

DR. ADOLPH MEYER will represent Clark University at the celebration of the 450th foundation of the University of Glasgow. Dr. Meyer is at present abroad, working in Germany and Switzerland.

PROFESSOR R. S. TARR, of Cornell University, will spend the summer vacation in Switzerland.

MR. T. NELSON DALE, geologist of the U. S. Geological Survey, who recently resigned his position as instructor in geology and botany at Williams College, will make his home, in September, at Pittsfield, Mass., and from that point continue his geological field work in eastern New York State and western Vermont.

DR. JUDSON SYKES BURY will deliver the Bradshaw lecture before the Royal College of Physicians in London, his subject being 'Prognosis in relation to disease of the nervous system.'

DR. IRVING COLLINS ROSSE, the author of various works on medicine and travel, died at Washington, on May 3d, at the age of forty-two years. Dr. Rosse was at one time professor of nervous and mental diseases in Georgetown University, and, in addition to his medical work, had taken part in several Arctic expeditions.

IT is announced that the Rev. James Chalmers, known for his anthropological observations in New Guinea, has been murdered by the natives.

DR. JOHN CAVAFY, formerly lecturer on physiology, demonstrator in histology and physician at St. George's Hospital, London,

has died at Brighton at the age of about sixty years. He was the author of numerous contributions to the medical journals.

MR. ANDREW CARNEGIE, who recently gave £6,500 to the British Institute of Mining Engineers for the encouragement of research, has now doubled this sum.

A TELEGRAM was received at the Harvard College Observatory on May 7th from Professor Kreutz at Kiel Observatory, stating that the south comet will appear in the Northern Hemisphere. It was observed at the Cape of Good Hope May $3^d.2115$ Greenwich Mean Time in R.A. $3^h\,40^m\,32^s.4$ and Dec. $-0°\,31'\,49''$ and was also observed May $4^d.2187$ Greenwich Mean Time in R.A. $3^h\,54^m\,29^s.2$ and Dec. $-0°\,18'\,27''$. The physical appearance is as follows: circular, less than $1'$ diameter, brighter than 3d magnitude, well-defined nucleus, tail longer than $2°$.

THE Society for the Promotion of Engineering Education will hold its ninth annual meeting at Buffalo, beginning on June 29th.

A CABLEGRAM to the New York *Times* states that at a meeting of the Royal Society last week a plan was considered to enlarge the scope of the Society, so that it should embrace literature, and the other subjects included in the five academies of the Institute of France. It is said, however, that no action was taken.

WE learn from the *Northwestern Daily Mail* of April 22d (Barrow-in-Furness, Lancashire, England) that an urn of ancient workmanship has been discovered below the upper Boulder Clay, in the Isle of Walney, near Barrow. The urn lay ten feet below the surface and some forty feet above sea-level in coarse sand on a pan of sandstone beneath the clay. The excavation was for brickworks, the manager of which is confident that the rock had not previously been disturbed. The urn is eight inches in diameter, with a wall average one-fourth inch in thickness composed of at least four layers of a very fine paste of a brown tint and exceedingly hard; its outer surface is smooth and unornamented. This important find is being further investigated by Mr. Harper Gaythorpe of Barrow-in-Furness.

IT is stated in the *Times* that experiments were carried out in London on May 1st by a party of balloonists under the direction of Mr. Percival Spencer, with the object of testing the general direction of the atmospheric currents across London and of investigating the phenomena of sound in the higher reaches of the atmosphere. Four balloons ascended from the Crystal Palace, St. Anne's-grounds, Barnes, the Welsh Harp, at Hendon, and the West Ham Gas Works. The balloon from the Crystal Palace, which ascended at 4:04 p. m., reached Dorking at 5:55. The balloon which left West Ham at 4 p. m. descended at Headley, near Epsom. The greatest altitude attained was 5,500 ft. Snow was encountered above the height of a mile.

THE annual meeting of the members of the Royal Institution was held in London on May 1st, Sir James Crichton-Browne, the treasurer, being in the chair. The annual report of the committee of visitors, testifying to the continued prosperity and efficient management of the Institution, was read and adopted, as was also the report of the Davy-Faraday Research Laboratory. Forty-seven new members were elected last year, and 63 lectures with 19 evening discourses were delivered. The following were elected as officers for 1901–1902: President, the Duke of Northumberland; Treasurer Sir James Crichton-Browne; Secretary, Sir William Crookes; Managers, Sir Frederick Abel, Sir William de W. Abney, Sir James Blyth, Sir Frederick Bramwell, Dr. Thomas Buzzard, Viscount Gort, Dr. Donald Hood, Lord Kelvin, Sir Francis Laking, Mr. Hugh Leonard, Dr. Frank McClean, Mr. James Mansergh, Mr. George Matthey, Mr. W. H. Spottiswoode, and Lord Justice Stirling; visitors, Sir Andrew Noel Agnew, Dr. C. E. Beevor, Mr. W. H. Bennett, Dr. Francis Elgar, Mr. Joseph G. Gordon, Dr. J. Dundas Grant, Lord Greenock, Mr. Maures Horner, Mr. H. F. Makins, Sir Thomas Sanderson, Mr. W. S. Squire, Mr. Harold Swithinbank, Mr. J. J. Vezey, Mr. Roger W. Wallace and Mr. James Wimshurst.

AT the meeting of the Council of the Royal Geographical Society, on April 28th, the Royal medals and other awards were made as follows: The founders' medal to the Duke of

the Abruzzi. The Duke undertook, at his own expense, in 1897, an expedition to Mount St. Elias in northwest America, which he for the first time ascended to its summit, 18,060 feet above sea level (July 31, 1897). In 1898 he organized, again at his own expense, an expedition towards the North Pole by the Franz Josef Land route. The expedition made a successful voyage to Franz Josef Land, where winter quarters were established. During the winter the Duke organized a sledge expedition to the north, and, being incapacitated by frost-bite from leading it in person, entrusted the command to Captain Cagni, who succeeded in reaching the highest latitude yet attained by man—86° 33′ or 22′ beyond Nansen's furthest. By this journey over the frozen ocean Captain Cagni disproved the existence of the land shown on the maps to the north of Franz Josef Land, the northern parts of which were for the first time accurately surveyed. The scientific work of the expedition included determinations of positions by astronomical observations, observations of the state and distribution of the ice, investigation of the meteorological and tidal phenomena, the aurora borealis, gravity, and the geology of the lands visited. The patrons' medal was awarded to Dr. A. Donaldson Smith, who in 1894 organized at his own expense an expedition for purposes of exploration between Shebel river and Lake Rudolf, which had at that time never been reached from the north. Starting from Berbera in July, 1894, he pushed southeast to the headwaters of the Shebel, on which he threw much new light, made a wide circuit to the south, crossing the Jub, and making his way westward to Lakes Stefanie and Rudolf. He explored the lower course of the Omo, skirted the east shores of Lake Rudolf and, striking southeast through hitherto unknown districts to the Tana river, reached the east coast, having thus traversed the whole extent of the Somali and Galla countries from north to south. In 1898 he organized a new African expedition for the purpose of completing his former work. Leaving Berbera in August, 1888, he again reached the north end of Lake Rudolf, making *en route* considerable rectifications of the map; and, continuing his march westward, crossed for the first time the unknown tract of country lying between Lake Rudolf and the Upper Nile. Throughout his journey he executed a careful route survey, carrying a triangulation through from Somaliland to the vicinity of the Nile, and supporting this by frequent astronomical observations with theodolite and chronometers. The other awards were made to Mr. Louis Bernacchi and Captain Colbech for their aid in the Southern Cross Antarctic expedition, and to Captain Cagni for his journey to 86° 33′ N., on the Duke of the Abruzzi's expedition.

Professor William Ramsay has issued a report on the subject of the proposed institute for post-graduate education, which a wealthy Parsee, Mr. Tata, recently offered to endow. This report, according to the London *Times*, states that the institute should be placed with reference to the situation of raw products; its site should be where the climate admits of energetic work during most of the year; and it should, if possible, be near a coalfield or some source of electric power. Bangalore is selected as an ideal site; for the Mysore State is rich in minerals (iron, gold, magnesite, manganese ore, corundum, &c.), and sugar-cane and the poppy are cultivated there. The climate is temperate, the place is easily accessible, and the Cauvery Falls can provide enough power for many factories. The Mysore Government have offered land for the institute, and would probably aid the scheme with pecuniary support in recognition of the benefits which would accrue to the State from its operations. Professor Ramsay discusses the salaries, period of office, vacations, duties and restrictions of members of the staff, and the method of appointment to chairs. He suggests that mechanics should be engaged to make apparatus and to teach the students to use their hands. A mechanician in brass and iron and a glass-blower might be procured who could train native boys to become skilled workmen capable of constructing apparatus and machinery as the work of the institute increases. Students should be selected from Indian colleges and should be graduates in science, except those who come from engineering colleges. The students would

accumulate at the rate of 15 to 20 a year, and the total number in the institute would not exceed 60, an ample number for a staff of nine teachers in research work. In order that the scheme may be set on foot, Mr. Tata's generous benefaction needs a supplement of about £5,000 from the Government of India. As the Viceroy and several members of his Council have promised favorable consideration, it may be hoped that this modest grant will be forthcoming. "I can imagine few ways," says Professor Ramsay, "in which a contribution from the State is likely to have such substantial and far-reaching results on the prosperity of the whole people. For the establishment of industries would result not merely in giving employment to the small number of experts for whom this Institute is designed, but to a vast army of clerks, artisans, workman and also merchants, whose object would be the disposal of the manufactured articles produced from the raw materials existing in the country; whereas, by exporting the raw materials as such, the country is impoverished, for their extraction gives employment only to navvies and to the railway companies."

UNIVERSITY AND EDUCATIONAL NEWS.

THE Legislature of Minnesota has recently appropriated $25,000 for a new laboratory of agricultural chemistry, and $25,000 for the erection and equipment of a building for instruction in, and investigation of, veterinary science.

PHILLIPS ACADEMY, of Andover, Mass., has established a department of archeology with a fund of $150,000. A museum is about to be erected. Dr. Charles Peabody, of Harvard, is hon. director, and Mr. W. K. Moorehead is curator. There are about 40,000 specimens with which to begin study. They were collected during the past six years by Mr. Moorehead for the founder, whose name, at his own request, is withheld from publication.

MR. H. M. HANNA has given to Western Reserve University $12,000 to establish a research fellowship in its medical school in the departments of physiology and pathology.

THE alumni of Columbia University are making efforts to collect $400,000 for a hall for the college. It is hoped that the building may be erected by the time of the celebration of the hundred and fiftieth anniversary of the founding of the University in 1904.

EFFORTS are now being made to promote the better equipment of Queen's College, Belfast. It appears that the chair of pathology has been endowed and that a laboratory of physics and engineering has been promised by Mr. Pirrie. The sum of £5,000 has been given by Sir James Musgrave.

GROUND has been broken for the new Administration and Science Building of Colorado College. The sum of $160,000 has been secured for its erection and equipment, of which sum Dr. Pearsons, of Chicago, and Mr. W. S. Stratton have each contributed $50,000. The building will contain laboratories in all departments of science, lecture and recitation rooms, and a large natural history and geological museum.

THE Kent Laboratory of Chemistry at Yale University is now being enlarged in accordance with the bequest of $50,000 by A. E. Kent.

THE courts have decided that the Loomis laboratory must be relinquished by New York University. It would in this case go to the Cornell University Medical College, but we understand that the litigation will be continued.

AT the conference of the Presidents of the State Universities held at the University of Illinois, on May 1st, 2d and 3d, the following subjects were brought up for discussion:

1. What can be done to stimulate publication among university teachers and graduate students without over-stimulating it?

2. Is a uniformity of system in keeping the records and making the reports of State universities desirable and practicable?

3. How does one get rid of a professor who is industrious and attentive to his duties, who has good sense, whose influence upon students is good, but who by lack of ability and training is paralyzing the instruction of his department?

4. Should entrance requirements for colleges of agriculture be lower than for other colleges? What technical courses might be offered in agriculture without entrance conditions?

5. What, if anything, do the State universities owe to applicants for admission who are mature and anxious to increase their working efficiency, but who cannot meet entrance requirements?

6. What proportion of the Morrill Fund is usually devoted to agriculture, and what to mechanic arts, languages, etc., or branches not connected with agriculture?

7. Can anything be done to promote system in 'Agricultural Experimentation' under the Hatch Act?

8. What is to be said concerning physical training departments and athletic matters?

9. To what extent should university authorities permit class rushes and scrimmages?

10. What is the wise policy touching university inspection of high schools?

11. Should our universities maintain summer schools? Or, are four regular terms in the year advisable?

12. What ought our universities to do concerning the professional training of teachers?

13. Is a uniform standard for 'units' or 'points' in entrance requirements practicable?

14. What ought the State universities to claim in reference to the right of their graduates to teach in the common schools without examination by local commissioners?

15. How can other educational interests secure such national cooperation and pecuniary support as are accorded to the agricultural interests?

THE Yale *Alumni Weekly* compares the changes in the election for senior studies next year with those of the class of 1886, when the elective system began. It appears that ancient languages fall from 34.8 per cent. to 23.9 per cent.; European languages rise from 10 per cent. to 14.7 per cent.; English from 9.2 per cent. to 14.7 per cent.; mathematics fall from 18.8 per cent. to 10 per cent.; natural sciences rise from 7.4 per cent. to 8.4 per cent.; philosophy falls from 9.1 per cent. to 5.6 per cent.; history rises from 7.2 per cent. to 10.1 per cent., and social sciences rise from 3.5 per cent. to 12.2 per cent.

THE Council of the New York University has accepted the resignations of the entire faculty of the School of Pedagogy, consisting of six members, including the Dean. A special committee which recommended this action was authorized to reorganize the faculty.

IT is expected that two new professorships will be established at the University of Toronto, one in geology and paleontology, and the other in mineralogy.

DR. FRANKLIN CARTER has resigned the presidency of Williams College after twenty years of service.

AT Columbia University Henry E. Crampton, Ph.D., has been made adjunct professor of zoology at Barnard College, and Mr. W. E. Kellicott assistant in this science. Mr. William Findlay has been made tutor in mathematics and Miss Julia L. Collis assistant in physics. In other departments of the University the following promotions and appointments have been made: George H. Ling, tutor in mathematics; Charles S. Forbes, assistant in mathematics; Alexis P. Anderson, curator of the herbarium; H. W. Shimer, assistant in paleontology; George I. Finlay, assistant in geology; George Canning Hubbard, assistant in analytical chemistry and assaying; Myron S. Falk, C.E., tutor in civil engineering; Adolph Black, instructor in civil engineering; Joseph C. Pfister, instructor in mechanics; A. L. J. Iveneau, tutor in metallurgy; Gilbert Tolman, assistant in physics; Holmes C. Jackson, assistant in physiological chemistry.

WILLIAM J. MOENKHAUS, graduate student at the University of Chicago, has been appointed assistant professor of zoology at the University of Indiana.

C. J. FRANCE, who expects to take the Ph.D. degree at Clark University, has been given charge of the biological work in the Jacob Tome Institute.

THOMAS HUDSON BEARE, professor of mechanical engineering at University College, London, has been appointed to the chair of engineering in the University of Edinburgh, in succession to the late Professor Armstrong.

J. J. SUDBOROUGH, D.Sc., senior lecturer and demonstrator in chemistry at Nottingham University College, has been appointed professor of chemistry, at Aberystwith, in place of Dr. Lloyd Snape, now Secretary for Education for the County of Lancaster.

DR. R. SPITALER, docent and assistant in astronomy in the German University at Prague, has been promoted to an associate professorship.

H. A. Rowland